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ELECTRICAL WORLD

FEBRUARY 20, 1932
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CELLANITE will be recognized as such a material. Its unusual insulating and mechanical properties elevate it above ordinary insulation. It is the logical outcome of intensified research.

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DILECTO — Laminated Phenolic material in sheets, rods, tubes, or machined parts.

MICABOND — Mica in its most usable form. sheets, tubes, machined, punched and moulded parts.

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CELLANITE has high insulation value. Average dielectric strength — 800/900 volts per mil. Power Factor 3. Dielectric Constant 5.5 It is unaffected by oil or grease.

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CELLANITE, unlike most insulating materials, offers resistance to the action of alkalies of moderate strength and moderate concentration. It does not deteriorate.

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FIBRE COMPANY
NEWARK, DELAWARE
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MINIATURES

One Instrument

OR

A COMPLETE *Unit*

The new Weston Miniature Rectangular Instruments may be purchased individually—also switch panels, connecting panels and supporting angle iron racks as needed. Standardized as to size and mounting, all parts are interchangeable. A practical money-saver whenever changing conditions necessitate rebuilding the 'board.

The new Miniature Rectangular Instruments, known as Model 610, are 4" wide—an unusually compact design. Mounted in a spot-welded angle-iron frame with switches and connecting panel, they form a Weston Miniature Control Unit—a strip only 5" wide that saves space, time and labor.

With these Units, several times as many circuits are controlled within the usual space. Several times as many control switches and instruments are within reach of one attendant. Quicker operation, closer supervision.

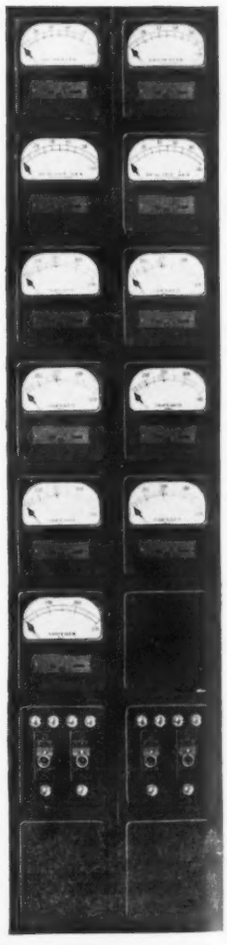
Instruments and instrument transformer connections are accessible at the front of the Unit. Less time and work for inspection. Instrument calibrations are checked from the front of the board without removing the connections from the back. Further savings in time and labor.

From individual instrument to complete control unit, the new Weston Miniatures are a combination of economy, efficiency and simplicity that intrigues the interest of every central station man.

—Write for Booklet WW—

Features of Weston Miniature Control Units

1. Reduced initial cost—no awkward or costly panel.
2. Reduced operating cost—one attendant can handle five times as many circuits.
3. Closer supervision—control of five times as many circuits in the same panel length.
4. Reduced "human error"—operator closer to instruments and control switches.
5. Quicker operation—more compact centralization of control.
6. Saves space—80% less space needed.
7. Ease and speed of installation—units shipped completely wired ready to connect to external circuits—additional units simply bolted on.
8. Flexibility of arrangement—all parts interchangeable and standardized as to size.
9. Practical freedom from maintenance—Weston's inimitable, sturdy, precise construction.
10. Ease of repair when damaged by unusually severe service—complete movement assembly easily removed.
11. Ease of inspection—all instrument and instrument transformer connections accessible at front of board.



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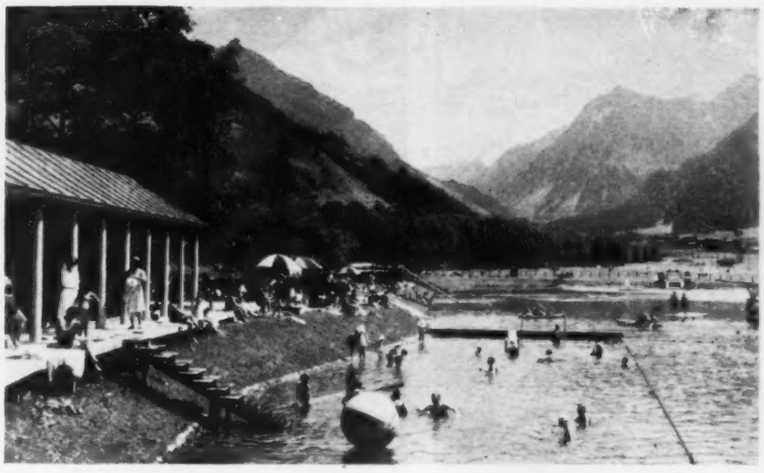

Electrically heated swimming pool, Klosters, Switzerland

FEBRUARY 20, 1932

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★
★
★

A New Control Cubicle

★

To control breakers on an auxiliary ring bus in a power plant.

★

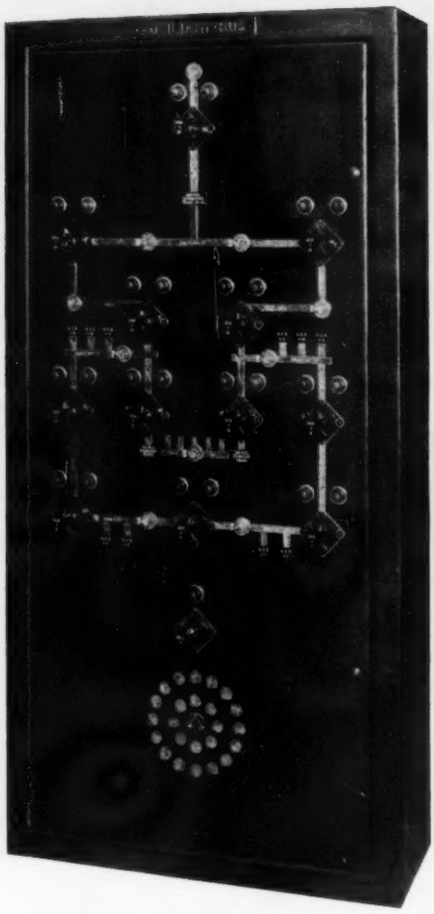
Station bus diagram is on cubicle door.

★

Neatly enclosed in steel.

★

Beautifully wired.



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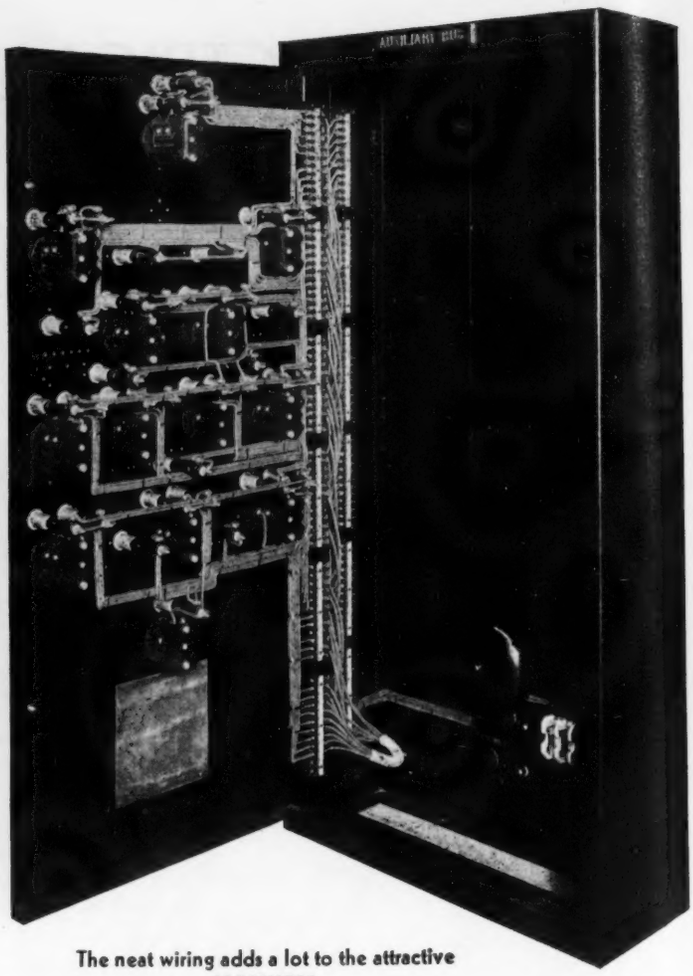


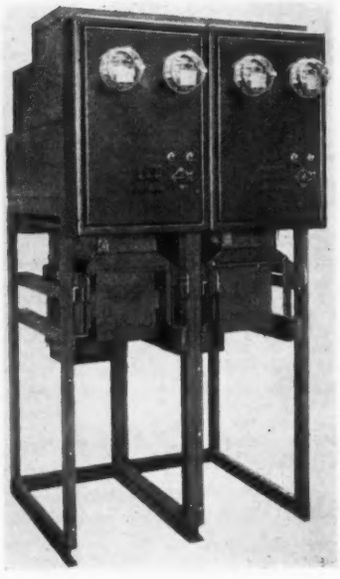
The neat wiring adds a lot to the attractive appearance

Above is pictured a Control Cubicle used to control 7.5 K.V. Oil Circuit Breakers of twenty Metal-Clad Switchgear Units, two of which are shown at the right.

The oil breakers of these units are part of a ring system as diagrammed on the face of the cubicle door, the busses being represented by copper and the cable by nickel strips. Therefore, any combination is plainly shown to the attendant and trouble on any section can be promptly located.

The Control Cubicle is located in the switchboard room and the Metal-Clad Switchgear Units are assembled in five groups located at various parts of the power plant nearest the station auxiliary they control, thus saving long cable runs.

Red and green indicating lamps show the breaker position. a white lamp showing potential on each bus section. In case of trip-out on any section the bell rings and an amber lamp lights. All units are plainly marked by means of engraved name plates.



A two-unit section of twenty units controlled by the cubicle pictured above

The solenoid operated 7.5 K.V. oil circuit breakers can easily be removed or replaced by means of a truck. An arrangement of interlocks prevents removal of breaker or insertion into the disconnects until breakers are in open position. Indicators on the front show whether breakers are in open or closed position.

(Prices upon Request)

DELTA-STAR ELECTRIC CO.

CHICAGO, ILLINOIS

2400 BLOCK, FULTON STREET

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

February 20, 1932

• It is only by working that we shall bring about the things for which we are waiting • Boom days of 1929 held greater menace than any depression • We can go forward, we can go backward — one thing we cannot do — we cannot stand still •

GEORGE B. CORTELYOU,
President
Consolidated Gas Company.

[Mr. Cortelyou was a speaker at the Stevens alumni dinner last week.]

7 per cent domestic energy tax?

—**According to new Mills plan** only home use of electricity and gas would be subject to federal levy. A revenue of $94,000,000 foreseen if 7 per cent consumer tax passes the House of Representatives and the Senate—*p. 338.*

—**Industrial energy consumption** shows 5 per cent rise in January as compared with December. Automobile production has undoubtedly been a strong factor. First improvement of this magnitude in a year—*p. 346.*

Edison and Lieb birthdays observed

—**Gifts of Insull and Barstow** install the late John W. Lieb's fine collection of Vinciana as a memorial at Stevens Institute. Edison Pioneers hold first meeting since the inventor's death—*p. 339.*

—**All 100-kv. lines in Germany** use Petersen coils for dealing with faults to ground. One company has about 1,200 miles of overhead line protected with equipment of 64,000-kva. capacity—*p. 362.*

Whither the holding company?

—**Future of top organizations** depends largely upon their ability to become adjusted to new conditions. Major economic readjustment of the world brings direct problems to this group—*p. 354.*

—**Savings of power interchange** calculated by a New England manager. Connecticut Valley Power Exchange saved its members $500,000 in 1931. Method applicable elsewhere—*p. 367.*

N.E.L.A. convention plans mature

p. 340.

—**Heat pump proves a success.** Reversed refrigeration cycle for space warming in new offices of Southern California Edison Company delivers the equivalent of 2.1 kw.-hr. for each kilowatt-hour input—*p. 349.*

—**Insulator supports 34 tons** when used as base for half-wave broadcasting tower approximately 900 ft. in height. Dielectric loss and subsequent heating was the main problem. Capacity is 50 mmf.—*p. 360.*

Secretary of Treasury Asks Energy Tax

OGDEN L. MILLS, newly appointed Secretary of the Treasury in succession to Andrew W. Mellon, on Tuesday of this week sent a letter to Representative Charles R. Crisp, acting chairman of the House committee on ways and means, making recommendations for additional revenue taxes. Among these was included as No. 4:

> A 7 per cent tax on domestic consumption of electricity and of manufactured and natural gas, estimated to yield $94,000,000.

It will be noticed that the proposed tax on electricity differs very materially from the one tentatively favored by Representative Crisp — a 5 per cent tax on all electricity sold — which would apply to industrial as well as domestic consumption.

[See ELECTRICAL WORLD, February 6, page 250.]

Ontario Considers Taxing Production of Electricity

For the first time in Canadian legislative history, it is said, a tax on electricity is being seriously considered. Such a tax—on the basis of 0.05-cent per kilowatt-hour—is reported to be a major item in the budget to be laid before the Ontario Legislature when it assembles in the near future. It is proposed to apply the tax to all utilities generating electricity, including the provincial Hydro system. For years private power corporations, headed by the Montreal Light, Heat & Power Consolidated, have been contending that they should not be taxed while the Ontario Hydro goes free.

▼

Negotiation Best Way of Fixing Rates, New York Commission Holds

NEGOTIATION of compromise rates rather than long-drawn-out, expensive valuation proceedings, possibly followed by litigation in the courts, is defended by the New York Public Service Commission in its annual report to the Governor and Legislature. The commission asserts that through negotiations with utility companies in 1931 it brought about reductions in gas and electric rates which will save consumers more than $7,400,000 annually. Reductions aggregating $1,000,000 more were on the eve of announcement at the end of the year.

The commission has, the report says, attempted not only to reduce rates but to simplify rate schedules, to establish uniformity and to eliminate rates which appeared to result in unfair discrimination. In one instance more than 20 different rates were combined into one residential and one commercial rate of general application to a large area. In conducting negotiations the commission made the points that prices had declined, that efficiency of generation and distribution had increased and that unless reductions were voluntarily made recourse would be had to formal rate cases. The report continued:

Consumers have appreciated that it is better to secure a reduction in rates promptly, even though it may not be as large as should be made in their opinion, and even though it may not be as large as might be ordered by the commission after a rate case had been conducted, extending over months and perhaps years, and possibly to be litigated in the courts. The companies, on the other hand, have appreciated that it is preferable to give their customers lower rates than they might expect to obtain from the courts after a long period of expensive hearings and litigation. They have realized that it is preferable for utilities to reduce rates voluntarily and to give to their consumers the large expenses they might be called upon to pay, and an additional reduction besides, than to attempt to secure what might be their theoretical rights under the Constitution of the United States, which might well prove to be a mere Pyrrhic victory.

It is hardly to be expected, however, that satisfactory results can always be secured by negotiation. The reasons are many. Some companies, principally those resulting from the acquisition or consolidation of many subsidiaries, are overcapitalized. During a period of rising prices and under an interpretation of law which required dominant weight to be given to reproduction costs such companies were able to earn a return not only upon the original investment in the underlying company but also upon reproduction cost less depreciation at the excessive prices paid during a period of inflation. With declining prices, such as those during the last few years, reproduction cost is rapidly approaching and in some cases has reached original cost—usually where a large amount of property was installed in the decade from 1917 to 1926. Such companies find it difficult to reduce their rates materially and yet earn interest and dividends, particularly the large dividends declared in recent years. In other instances, the policy of the management is to make no reductions until they are forced to do so after investigations and hearings before the commission and litigation in the courts. This may be an unwise policy, but nevertheless it is adhered to by some public utility corporations.

▼

PROPOSED EDISON MEMORIAL AT MENLO PARK, N. J.

—Hugh A. Kelly and John B. Peterkin, Architects.

Edison and Lieb Birthdays Bring Tribute of Pioneers

On Thursday of last week, the eighty-fifth anniversary of the birth of Thomas A. Edison, the Edison Pioneers held their first annual meeting since his death on October 18 last. Morning memorial services were conducted in the laboratory in West Orange, N. J., and later, in New York, at the thirteenth anniversary luncheon of the Pioneers, early associates, and life-time friends spoke, through very briefly. President W. S. Barstow of the society was chairman.

Mrs. Edison was present and was prevailed upon to utter a few sentences in addition to an inspirational letter from her which was distributed in printed form. Samuel Insull of Chicago, former president of the Pioneers and a friend and associate of Edison for more than 50 years, feared to subject himself to the emotional strain of tribute and reminiscence. Alfred O. Tate, a vice-president of the society, pledged the Pioneers to pay annual tribute to Edison as long as their association survives.

At the annual meeting Mr. Barstow, who was re-elected president, told of the plans of the New Jersey commission appointed to consider ways and means of erecting a suitable memorial to Edison at Menlo Park. An architect's drawing (reproduced on the opposite page) was shown of the proposed structure, which would consist of a memorial museum with an "eternal light" to replace the temporary light already installed. A 175-ft. tower would support a translucent, permanently illuminated globe. At the meeting last week Mr. Barstow unveiled a bust of Edison presented to the Pioneers on behalf of the American Institute of Electrical Engineers.

The birthday of the late John W. Lieb, who assisted Edison in starting the historic Pearl Street station in 1882 and who became vice-president and general manager of the New York Edison Company and was at one time president of the Edison Pioneers, was also observed on February 11, though the actual anniversary fell on the following day. The observance took the form of a formal opening at Stevens Institute, Hoboken, N. J., of the probably unrivaled collection of notebooks and sketches made by Leonardo da Vinci. The assembly of these was for many years an avocation of Mr. Lieb. Their donation to Stevens Institute has been due to the generosity of Samuel Insull and W. S. Barstow. Mr. Insull purchased the collection intact, and Mr. Barstow supplied the funds to build the rooms in which it has been placed.

In the evening many men of note, including a delegation from the Edison Pioneers, met in New York with Stevens alumni to pay further tribute to the work of Mr. Lieb. Speakers included Samuel Insull, W. S. Barstow and George B. Cortelyou.

▼

Interest in Power Bills Peters Out in Bay State

Little evidence of interest on the part of either the state authorities or the public in proposed power legislation was manifested this week at a hearing of the committee on power and light held at the State House in Boston on Monday. Governor Ely sent no representative to press his suggestions regarding tentative measures to protect the investing public against "stock watering," and Representative Birmingham of Boston, who sponsored a number of anti-utility bills last year, did not appear.

Attorney W. C. Marshall of Watertown asserted that control of holding companies was essential to prevent the gouging of consumers, and W. H. Walker of the Boston Public Franchise League supported three bills designed to make easier the entry of cities and towns into municipal ownership. B. Loring Young, for the New England Power Association, challenged Mr. Walker's figures. M. H. Sullivan of the Boston Five Cents Savings Bank opposed holding-company legislaiton as a peril to bank investments.

Business Outlook Brighter; Figures Still Unfavorable

MORE specific legislative attempts at banking relief have made business more cheerful this week than for many months. Bank failures are fewer and Washington reports hoarding partially checked. Advancing government bond prices presumably reflect greater confidence, plus the impression that the Reserve banks will increase their U. S. government bond holdings over a period to facilitate the financial program of the treasury.

But statistically there is little improvement. Despite a better outlook for steel demand from the automobile and other industries, steel men do not anticipate any substantial gain in orders and plant operations before April. Steel operations are down slightly this week.

Output of electricity is down about 6 per cent this year. The outlook for resumption of financing operations by the utilities and therefore the advancement of construction and replacement projects improve.

Business failures are down 20.7 per cent, Bradstreet's reports.

▼

Editors Defend Utility Merchants

A resolution recently adopted by the Kansas Press Association at Wichita urges repeal of the Kansas law prohibiting the sale of merchandise by utilities on the ground that it is "depriving cities and towns of adequate service and contributing to empty storerooms and unemployment." Newspaper men asserted that merchandising formerly done by utility companies was now going to mail-order houses.

▼

PIONEERS GATHER IN MEMORY OF EDISON

Left to right — Charles L. Edgar, Mrs. Edison, W. S. Barstow, W. H. Meadowcroft, the inventor's confidential secretary, and Samuel Insull. The two men last named were closely associated with Edison for half a century.

Presidential Message on Bureau Reorganization

Mr. Hoover Also Gives His Views on Federal Power Plants, Holding that They Must Reimburse the Government

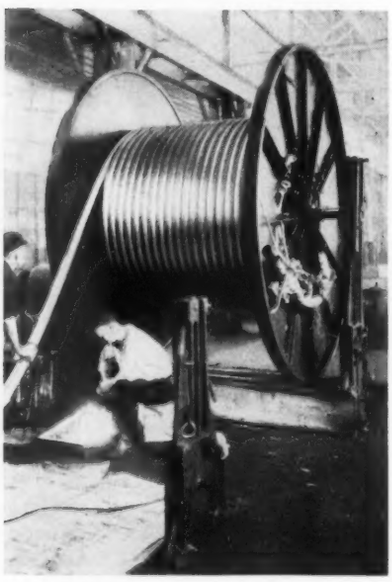
Reorganization of governmental activities in the interest of economy and efficiency was asked by President Hoover in a message to Congress on Wednesday of this week. The President desires authority to consolidate federal agencies and to rearrange the duties of officials, establishing new assistant secretaryships and distinguishing on logical lines between boards and commissions with quasi-judicial functions and executive bureaus. He asks for establishment of a "public works administrator" and a "personnel administrator."

Dealing with the Reclamation Bureau, the President says:

Reclamation should have a broader import than that of bringing unproductive land under cultivation. . . . Where water power is developed as a byproduct it should be disposed of in advance by contracts which will fairly reimburse the government for its outlay. . . . Such important projects as the dam at Boulder Canyon, the dam at Cove Creek, the development on the Columbia and the dam on the Umatilla should ultimately be undertaken when there is need for such service and when contracts can be made for the sale of power to amortize the cost of construction to the government. The actual construction work under this plan should be carried out by the public works administrator and the completed projects administered by the Reclamation Service.

▼

TO CARRY 115 KV. UNDER THE COLUMBIA



Reeling the General Electric oil-filled submarine 750,000-circ.mil single-conductor cable which will form part of the Northwest Electric Company's high-tension line from its Ariel hydro plant to Portland, Ore. For the present it will be operated at 66 kv.

Quarter-Cent Energy Tax Proposed in Kentucky

An administration measure in Kentucky provides for a tax of 0.25 cent on each kilowatt-hour of electrical energy sold. If passed, it is expected to raise $1,200,000 annually. This and other recommendations, including one for a 2 cent tax on 1,000 cu.ft. of gas, were made by a House research committee and entered on the journal. It is understood that the tax on power would be both on consumption in the state and on exported electricity.

Bills have been passed permitting cities of the less populous classes to own and operate light and other utility plants by issuing bonds to be paid out of revenue. Another bill reported aims to prevent passing to the consumer of taxes on utility consumption.

▼

Compromise Seems Likely on South Carolina Bill

Enactment of the bill proposed by the South Carolina Legislature's power-rate investigating committee was urged by Governor Ibra C. Blackwood last week in a special message. He also recommended that means be provided whereby the South Carolina Railroad Commission may co-operate with the North Carolina Corporation Commission in making a joint appraisal of the properties of the electric utilities that serve both states, to the end that a proper rate base may be found. He agreed with the recommendation of the committee that the kilowatt-hour tax should be amended to provide for its application at the point of sale and to eliminate the levy on exported power.

The chief electric power companies of South Carolina have agreed not to fight the proposed regulation act if certain minor amendments are adopted. A. F. Woods, counsel for the investigating committee, and T. B. Pearce, its chairman, have recommended that these amendments be incorporated in the bill now before the General Assembly.

After the committee had submitted a proposed bill to the Legislature, representatives of the five large companies affected by the findings of the probers appeared before the general counsel and chairman of the committee and asked for amendments. Following a long discussion the committee members agreed to some of the suggestions but declined to consider others. Representatives of the power companies then declared that they were willing to give the recommendations of the committee a trial with the right to ask amendments next year. They declared, however, that there are many things in the bill that ought not to be there.

The amendments recommended by the committee counsel and chairman will be considered by the judiciary committee, but as yet have not been accepted. No further public hearings are expected. Indications that a fight will be made on the question whether municipally owned power plants shall come under provisions of a regulatory act were seen.

▼

Light Sought in Vain on 25-Year-Old Contract

A 25-year-old contract between the Tide Water Power Company and the Tide Water Construction Company, was the chief subject of inquiry when the public utility investigation being made by the Federal Trade Commission was resumed on February 16. Examiner Aaron J. Hughes professed himself unable to determine what the construction company had done in return for $575,000 of common stock given it by the power company, which, he said, itself did the construction.

Hugh MacCrae, early president of Tide Water, was unable to clear the transaction up because of the lapse of time. The utility passed into Fitkin control in 1922 and to the Insull interests in 1927. It is now operated as a subsidiary of the Seaboard Public Service Company. Local headquarters are at Wilmington, N. C.

Hearings were continued on February 17.

▼

N.E.L.A. Convention Plans Get Under Full Headway

Talk of curtailing or modifying the annual convention of the National Electric Light Association has been abandoned, and preparations for the great gathering at Atlantic City on June 6 to 10, with the concurrent manufacturing exhibition, will soon be in full swing at headquarters. It has become the conviction of N.E.L.A. officers that vigorous meetings and crowded exhibits are even more important in a time of business depression than in a period of full prosperity. President J. F. Owens is emphatically of this opinion and has officially declared his belief that a normal attendance can confidently be expected and that no thought of abandoning a complete exhibition should be entertained.

Municipal Utility District Bills at Albany Again

Backed by a special message from Governor Franklin D. Roosevelt, a bill has been introduced in both houses of the New York Legislature amending the general municipal law by allowing the creation of municipal utility districts, with power to acquire, own and operate public utilities. It is supplemented by another bill amending the public service law so as to enable the Public Service Commission to grant franchises to such municipal utility districts.

Under the terms of the municipal utility district bill, each district would be created by petition, hearing and vote of the people and must with certain exceptions embrace contiguous territory. The district would be a body corporate and have the power to issue bonds and obligations to purchase or otherwise acquire and to operate or lease the right to operate public utilities specified in the resolution creating the district. Broad powers are conferred upon the commission under the supplementary bill. Among other things the bill permits the acquisition by a municipal district of the property of a utility corporation to be declared a public necessity.

These measures are in the main similar to the bills introduced on the same subject last year. The Governor in his message held that last year's bills had no adequate consideration. "There can be no valid objection to this legislation, except from those utility corporations which seek to maintain as exorbitant rates as possible," the message said.

Passage of the bills was urged by Delos M. Cosgrove, vice-chairman of the New York Power Authority, in a speech on "Economic Aspects of the St. Lawrence Power Development," delivered in Syracuse on Monday night.

▼

Offer to Complete Diablo Plant Made to Seattle

In an offer made to the Seattle City Council Bayly Hipkins, construction engineer and contractor, proposes to complete the City Light Department's 199,000-hp. Diablo power house, providing employment for 250 men for the next fifteen months. His proposal, in writing, provides for taking $3,210,000 of City Light 6 per cent bonds at par and accrued interest in behalf of himself and a syndicate of manufacturers and contractors.

Mr. Hipkins agrees to purchase for cash $1,374,000 worth of the bonds, with the understanding that the proceeds will be used by the city to pay off warrants and other obligations for labor, materials and equipment already furnished or yet to be furnished under existing contracts on the Diablo plant. He also agrees to purchase $189,000 of bonds of which the proceeds will be used for cashing warrants issued for the construciton of the City Light Building. His offer is conditioned upon his being awarded a contract to furnish the labor, material and equipment necessary to complete construction of the Diablo plant. For this he agrees to accept $1,647,000 worth of bonds in lieu of cash.

The Hipkins proposal was received by the City Council after the Comptroller had failed to receive any bids on a issue of $3,000,000 in City Light bonds, under a call recently published. A Portland financial firm notified the Comptroller that it might make an offer if given more time to complete plans.

The proposed Hipkins contract would cover construction of the power house and tailrace, a double transmission line from Diablo to the Gorge, and installation of generators and waterwheels which have already been purchased by the city. Contracts already completed at Diablo cover construction of the penstocks, power tunnel and foundations for the power house. It is for the purpose of providing funds to pay off the $1,374,000 still due on these contracts that Mr. Hipkins agrees to take bonds to that amount. The Diablo dam, long completed, has been paid for in full.

▼

North Pacific States and Columbia River Project

State-owned power will be before the people of Oregon as an election issue this year or next if two events occurring in that state the latter part of January mean what they appear to. One was the filing by the State Grange of a proposed constitutional amendment as already reported (January 30, page 208). The other was the first meeting of the Governor's "Superpower Committee of Oregon."

This committee, composed of the State Attorney-General, the State Engineer and three members appointed by the Governor, including John H. Lewis, consulting engineer, Portland, and J. W. McArthur, supervising engineer Eugene municipal power system, is authorized by law to suggest legislation "providing for the co-operation of superpower districts in Oregon, Washington and Idaho, whereby publicly owned plants in such states may be interconnected by transmission lines, to the end that all economies may be made available to the public through interconnection over a wide area." Mr .Lewis was elected chairman.

Findings of fact by the committee were that interconnection would bring about economies due to diversity in peak-load conditions of widely scattered communities and to diversity of streamflow conditions and would save duplication of steam stand-by power equipment. The committee will devise legislation providing for state ownership of power plants and transmission lines in Oregon to pave the way for a possible intrastate system and will seek reciprocal legislation in Washington and Idaho.

Mr. Lewis, who was formerly state engineer, has long been an advocate of public power development. He envisions a great publicly owned network in the Northwest consisting principally of large federally owned generating plants on the Columbia River, supplemented by smaller state-owned plants on strategic streams, with the states as purchasers of federal power, transmitting energy over their own lines and selling it at wholesale to municipalities, power districts, private power companies and large industrial users for distribution or use by such agencies.

Coming Meetings

North Central Electric Association—Engineering Section, St. Paul Hotel, St. Paul, Feb. 22 and 23. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Oklahoma Utilities Association—Tulsa, Okla., March 8 and 9. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Pacific Coast Electrical Association—Engineering and Purchasing and Stores Sections, Fresno, Calif., March 9-11; Commercial Section, Santa Cruz, Calif., March 17 and 18. K. I. Dazey, 447 Sutter St., San Francisco.

American Institute of Electrical Engineers—District meeting, New Pfister Hotel, Milwaukee, March 14-16; Providence, May 4-7. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—Group committee meetings, Commercial National Section, Edgewater Beach Hotel, Chicago, March 22-24. A. J. Marshall, 420 Lexington Ave., New York.

Maryland Utilities Association — Lord Baltimore Hotel, Baltimore, April 8. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

New England Division, N.E.L.A.—Engineering Section, Boston, March 3 and 4; safety conference, Boston, April 8. Miss O. A. Bursiel, 20 Providence St., Boston.

Great Lakes Division, N.E.L.A.—Engineering Section, Sherman Hotel, Chicago, April 13 and 14. R. J. Malcomson, 72 W. Adams St., Chicago.

Northwest Electric Light and Power Association — Engineering Section, Heathman Hotel, Portland, April 13-15; H. H. Schoolfield, Pacific Power & Light Company, Portland. Accounting Section, Davenport Hotel, Spokane, Wash., April 18-19; W. F. Miller, Washington Water Power Company, Spokane.

Arizona Utilities Association—Tucson, Ariz., April 13-15. J. S. Arnold, Central Arizona Light & Power Co., Phoenix, Ariz.

Electrochemical Society—Lord Baltimore Hotel, Baltimore, April 21-23. C. G. Fink, Columbia University, New York.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 25-28. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 28-30. Jesse Blythe, 103 West High St., Jefferson City, Mo.

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Program for A.I.E.E. Milwaukee Meeting

At the Great Lakes District meeting of the American Institute of Electrical Engineers, to be held at Milwaukee March 14 to 16, there will be three technical sessions, one on each day. The first session will embrace treatises in the fields of research and communication. The second session will bring forth a paper on the development of the Waukegan (Ill.) generating station and one on its electrical design features. Another paper at this session will describe a 115,000-kw. turbo-alternator, and still another will treat of weather resistant insulation for line wires. The third session will include papers on spark-over, 60-cycle primary transmission systems, limiting gaps for protecting station apparatus, and variation in diameter and spacing of suspension insulators. A session for students within the district will also be held.

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MISSOURI'S TALLEST BUILDING HOUSES K.C.P. & L.

The Kansas City Power & Light Company started 1932 in its new building, of which it occupies 20 of the 32 floors, the three lower ones being equipped for complete air conditioning. The first night view (left) has just been taken. If floodlights are off, a red beacon light on top of the building is turned on by a photo-electric cell.

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Merchandising Views of New York Commission

Sale of appliances by electrical and gas utilities was the subject of a recent opinion promulgated by the New York Public Service Commission. This report, written by Chairman Milo R. Maltbie, reaches the conclusion that "merchandising by public utilities is justified only upon the ground that it is a necessary function in order to provide adequate service to the public at reasonable rates." Mr. Maltbie also holds that "separate bills should be rendered for appliances or any service other than gas or electricity" and that "a public service corporation has no right to discontinue service because merchandise bills are not paid." The opinion says further that "the establishment of an accounting system for merchandising should be undertaken at once," with a fair trial.

The report recommends that no general order be issued at this time prohibiting merchandising, but that in case specific complaint be made regarding the practice of any company, such complaint be taken up and an order issued in the case after hearing. "It is desirable," the commission thinks, "that utilities should engage in merchandising only where it is necessary in order to provide for the introduction of appliances upon reasonable terms and to supplement what private agencies are doing." It is also recommended that an accounting system and form of report be prepared which will show the full and complete cost of merchandising operations of public service corporations and that when these are prepared a hearing be held to give the utilities an opportunity for criticism and suggestion.

A discussion is included on the question of the legal authority of utility companies to engage in the merchandising business. The right of electric corporations and of combined gas and electric corporations to deal in electric appliances is held to be indisputable.

"Until more definite information is available and the facts established, such as would be provided by a proper accounting system, I recommend that no ruling be made as to the disposition of the profit or loss," the opinion continues. "There is one point, however, which is reasonably clear, namely, that the losses should not be capitalized and conversely that there is no basis for deducting profits from capitalization."

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Philadelphia Electric Man on Merchandising Policy

How gas and electric appliances are merchandised by the utilities of Pennsylvania was outlined last week to the members of the Pennsylvania and Atlantic Seaboard Hardware Association by George E. Whitwell, vice-president in charge of sales of the Philadelphia Electric Company and chairman of the Pennsylvania utilities merchandising committee.

"If the uses of these modern electrical appliances are to receive wide acceptance, the burden of popularizing them has been and will be with us," Mr. Whitwell said. "The utilities did not enter the merchandising field as a matter of choice. The promotion and sale of appliances is an essential function of the gas and electrical industries if they are to continue to render better service at lower rates and extend their services to those not now enjoying them. The utilities in Pennsylvania, depending upon whether this territory is rural or urban, sell on an average from 10 per cent to 30 per cent of all gas and electrical appliances. The rest are sold by the retailers. Statistics for most localities show that the hardware dealers get less than 5 per cent of the business. The lion's share goes to the department stores, installment houses and to direct-selling organizations working out of so-called specialty stores.

"The utilities in their advertising and merchandising endeavor to build up acceptance of appliances on a quality basis. The utilities are ready to lead the way in advertising, promoting and building a market."

Utility Investments, Inc., Omits All Dividends

MARKET weakness last week in the Insull stocks, including Utility Investments, Inc., was followed by suspension of dividends on the stock of this unit. The dividends omitted are the quarterly payments of $1.50 on second preferred, $1.38 on the 5½ per cent preferred and 1½ per cent in stock on common stock, all due at this time.

The passing of these dividends has been connected, in public discussion, with the bank loan situation, and it is inferred that the passing of these dividends favored a continuance of the loans advanced to Insull Utility, Inc., and Corporation Securities Company of Chicago. Loans to the two organizations are said to approximate $73,000,000. It is obvious that the omission of the preferred and common dividends will make it easier to meet or reduce the bank loans. In the aggregate, Insull Utility Investments, Inc., owes approximately $53,000,000 to various banking institutions, compared with $58,476,000 at the close of 1930, while Corporation Securities owes approximately $20,000,000 to the banks. Five leading banking institutions are said to participate in the credit.

Consolidation of the two Insull investment trusts—Insull Utility Investments, Inc., and Corporation Securities Company of Chicago—is being considered. This information was given out by Samuel Insull, Jr., in the annual reports of the two companies just issued. It might also be advisable to plan a consolidation with some other company under the same general management.

Samuel Insull presided at the annual meetings of the two trusts and explained how so great a depreciation in values had been incurred. He said:

> I exercised and my associates exercised exactly the same judgment in purchasing stocks for our companies as all you stockholders exercised in purchasing Insull stocks. In the light of today, that judgment was very poor. I did as people all over the world did at the time; I did the best I could, according to my knowledge and ability. I had no knowledge that we were in for a world crisis that would sweep values throughout the world and rock things to their foundation. That is my answer to those who criticise me for paying $300 a share for Commonwealth Edison stock.
>
> As stockholders you have suffered greatly. But in proportion I have suffered just as much myself. With the exception of common stock dividends received by me and my family, which we needed to sell, the Insull family is in possession of just as much stock of these two organizations as it was on the day they were formed. We are in the same boat that you are in. I have done the very best I know how, and I have done it honestly. There is not a person here who suffers as much in pocket and in reputation as I do. But I hope to carry the thing through to a final successful conclusion.

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Banker Anticipates Better Bond Market

An expanding bond market, to the detriment, perhaps, of the market for stocks, is anticipated by F. J. Lisman, investment banker. He expressed this opinion in an address to the financial advertising group of the Advertising Club of New York last week.

Mr. Lisman predicted a greater demand for bonds than for stocks when buying gradually increases. When new financing is resumed on a large scale Mr. Lisman believes that the number of houses of issue will be smaller. He believes that there are many in the field who should not be there.

With regard to future prospects, Mr. Lisman points out that as the cost of living goes down there will be an increasingly large surplus of money available for investment in securities. He stated that many securities at present are at ridiculously low prices and believes that the general investing public will take advantage of these prices in a large way just as soon as the present fear complex has been overcome. "We are not in a new era," Mr. Lisman said. "I am inclined to think that we are back to an old era after having been through a fantastic debauch."

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British Electrical Output Increased in 1931

In spite of the general slackness of industry, the British electrical trade continues to make progress. Returns recently issued show a further advance in the output of current suppliers during 1931, the year's total being 4.46 per cent greater than in 1930. This, the ELECTRICAL WORLD's London correspondent comments, should be cheerful news to holders of electricity supply shares.

Even more encouraging as an indication of the progressive nature of the industry is the fact that the output for each quarter in recent years has been higher than for the corresponding quarter of the preceding year. Since 1924 the annual output has increased by 87 per cent. Another encouraging factor is that the output for the last four months of 1931 was 6 per cent more than in the corresponding period of 1930. This increase is presumably

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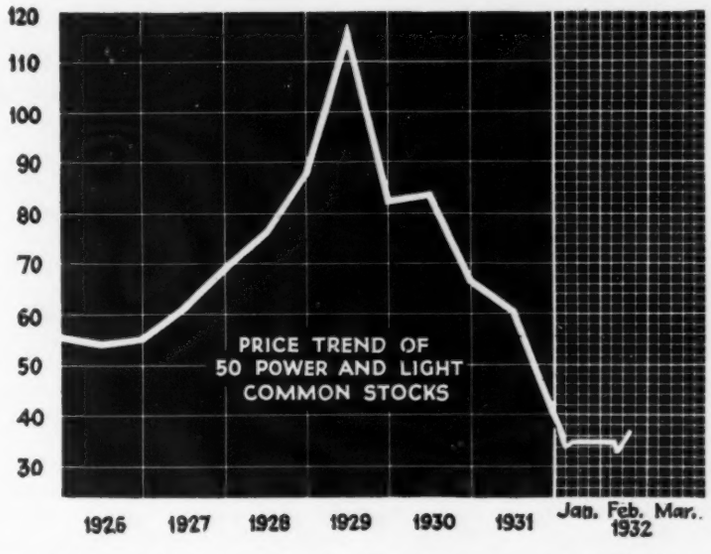
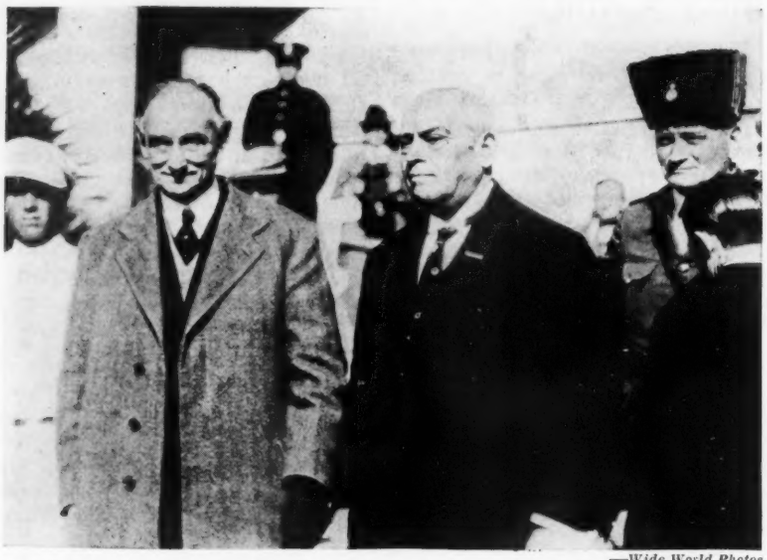
Relief Prospect Boosts Stocks



The spectacular market rise induced by the prospect of legislation designed to ease liquidation has brought utility stock averages up several points following a dip to the low point for the depression. The movement was accelerated by the rush of shorts to cover. Several power and light stocks gained from 20 to 30 per cent in three rising market sessions. The average of 50 representative stocks advanced from 32.9 a week ago to 36.1 the middle of this week. Utility bonds also made substantial gains during the week.

PRESIDENT OF RUTTENBERG WORKS VISITS PALESTINE



—*Wide World Photos*

The Ruttenberg Electricity Works, which now supply Palestine with water power, have been completed. Lord Reading (left), president of the works, is seen with the Mayor of Tel-Aviv just after being made an honorary freeman of that city.

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due in part to the opening of factories following the abandonment of the gold standard by the United Kingdom.

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Vermont Commissioner Advises Amalgamation

Merging of small electric companies that have suffered from business conditions and are unable to provide adequate service individually is urged by Henry B. Shaw, chairman of the Public Service Commission of Vermont.

These companies were set up over a period of years by public-spirited citizens on a co-operative basis. Under adverse conditions, however, in many cases rates have been found inadequate and plant deterioration has resulted. It is not practical for commissions to order costly improvements by a utility that is losing money. The best remedy, Mr. Shaw believes, is to try to sell such units to strong, well-financed and ably managed companies in adjacent territory.

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British Electricity Board Floats Huge Loan

Arrangements are being made for the issue in the near future of £7,000,000 of stock by the British Central Electricity Board at 95. The interest will be 5 per cent. Redemption dates will be 1955-75. The first interest payment will be made in October. The size of the issue ($35,000,000 at par) surprised financial circles in London, as a considerably smaller amount was anticipated.

The Central Electricity Board was constituted under the electricity (supply) act, 1926, to construct main transmission lines, commonly known as "the grid," to concentrate the generation of electricity at standard frequency in the most efficient stations, and generally to increase the availability of electricity throughout the country and reduce the cost of production.

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Utility Revamps Capital During Adverse Period

Taking advantage of certain conditions inherent in a bad business period, the Public Service Company of Northern Illinois has just completed a twelve-month program under which it has practically revised its entire capital structure. The net effect is lower fixed charges and a more equitable ratio between junior and senior portions of capital structure, providing an increasing backlog for senior financing when the market is more receptive to new flotations.

Last spring, when interest rates were low, but before the bond market petered out, the company sold the largest bond issue it had ever floated, a $40,000,000 issue of 4½ per cent bonds, series F. This provided sufficient funds to retire $22,250,000 of 5½ per cent bonds, series A, due in 1962, and $5,000,000 of the same issue, series B, bearing the same coupon. It also provided for the redemption of a $10,000,000 issue of 5 per cent debentures. The company later sold $15,000,000 of one-year 4 per cent gold notes to discharge bank loans.

A large program of equity financing was also carried out. Early in the year about $11,000,000 was raised through an offer of rights to stockholders. Again, in December, 97,737 shares of common stock were offered to stockholders at $100 in the ratio of one new share for each eight held, of all classes. The subscription period ended a few days ago. Part of this was used to retire an issue of bonds. An addition of 200,000 shares was made to the authorized capital stock, bringing the total to 700,000.

The balance sheet at the beginning of 1932 showed funded debt of $107,584,500, $15,000,000 of 4 per cent notes, $16,357,600 of preferred stock and $61,715,700 of common stock, entered at $100 a share. The latter thus accunted for 30 per cent of total capital liabilities, preferred stock 8 per cent, bonds 53.6 per cent and notes 7.4 per cent.

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Commonwealth Edison Earnings Well Maintained

Operating revenue of the Commonwealth Edison Company for 1931 amounted to $80,551,164, against $84,004,438 in 1930. Net income after depreciation, taxes and charges amounted to $16,322,541, or $10.40 a share. Net income for 1930 was $16,402,588, or $11.51 a share on smaller number of shares outstanding. Surplus earnings after expenses and depreciation and preferred dividends were $4,249,693, against $5,838,318.

During the year the company took advantage of low interest rates to retire or provide for the retirement of the first mortgage bonds, issuing $85,000,000 first mortgage 4 per cent gold bonds. The proceeds were used, in part, to redeem $51,774,000 of higher interest bonds and in part for other purposes. In August the company sold $20,000,000 worth of 3½ per cent gold notes, due July 30 next. There were no current borrowings as of December 31.

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Italian Utility Decreases Dividends

Edison General Italian Electric Company has declared a dividend of 8 per cent for 1931, as compared with 12 per cent in 1930.

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Bond & Share May Change Par

Reduction of the stated value of the common stock of the Electric Bond & Share Company to $5 from $10 and the exchange of one new share for each three old shares held were considered by directors February 19.

Twenty-five-Million-Dollar Loan by Brooklyn Edison

General mortage gold bonds, series E, of the Brooklyn Edison Company, Inc., were offered to the investing public on Wednesday of the past week to the amount of $25,000,000, the price being 97 and interest, yielding about 5.25 per cent. These bonds, dated January 1, 1932, and maturing January 1, 1952, are secured, in the opinion of counsel, by a direct mortage on all property and franchises of the company, now owned or hereafter acquired, subject to $11,-951,000 prior liens of closed underlying mortgages.

This entry of the Brooklyn Edison Company into the market marks the second venture of a subsidiary of the Consolidated Gas Company of New York this year. Late last month the New York Edison Company issued first and refunding mortage 5 per cent gold bonds, a piece of financing involving a total of $25,000,000.

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National Sign Week

To further the utilization and acceptance of electrical advertising the period of March 14-19 has been designated as National Sign Week. The Commercial National Section of N.E.L.A. contemplates the publication by member companies of full-page newspaper advertisements devoted to expressions of appreciation from both individual companies and the association. President J. F. Owens in summarizing the advantages of the sign load has said:

"The promotion of electrical advertising should be a major objective in the new-business campaigns of every utility. From every angle such business is highly desirable. It takes the commercial lighting rate, is largely off-peak, has a load factor of 20 per cent to 25 per cent, fluctuating only with the seasons; is obtainable at a low selling expense and entails little or no additional investment."

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Parent Company Disappoints Missouri Commission

A recent instance apparently indicates that the Missouri Public Service Commission, which, in spite of protests, has frequently permitted non-resident holding or operating companies to buy and hold more than 10 per cent of the capital stock of Missouri public utilities on the theory that the outside companies might be able to render valuable financial, engineering and managing assistance to the utilities from time to time, is not so certain on that point as it was. In a decision authorizing the Missouri Gas & Electric Service Company of Lexington, an operating utility controlled by the Middle West Utilities Company, to sell $224,000 of its 5 per cent first mortgage bonds at not less than 75 per cent of par value for financing purposes, the commission said it took this step "reluctantly." The appoval was granted after the company at a hearing had asserted that it had been unable to sell the bonds at the minimum of 82 fixed by the commission in a prior order issued on November 19, 1931.

"It is disappointing to the commission to observe in the present instance that the support upon which the commission has believed the local utility might rely in times of stress should prove so frail," the commission commented.

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Kansas Commissioner Cites Utility "Crimes"

Thurman Hill, member of the Kansas Public Service Commission, which is engaged in a struggle with the Henry L. Doherty and other utility interests operating in Kansas, in the course of a public address, said recently, addressing himself to the holding-company question:

One of the greatest obstacles in the way of reduction of public utility rates is the overcapitalization of public utility companies. They are now witnessing the beginning of an era of atonement for their earlier sins of overcapitalization in the period from 1915 to 1928 when money was plentiful and easily obtained.

If securities have been issued in excess of the cost of reproduction new of the operating units, less depreciation, there is a tendency on the part of the holding company to maintain the earnings of the operating unit on a high level, regardless of the local conditions involved, in order to enable the holding company to obtain sufficient revenue to pay the interest on its bonds, take care of the dividends on its preferred stock and pay dividends to the common-stock holders.

This is one of the crimes committed in financing utilities. Another is the excessive cost of money borrowed by the utility companies in the Middle West from Eastern financial institutions. Commissions have in good faith approved bond and stock issues for such companies, expecting the bonds to realize a price near par. In too many cases the greedy bond houses have refused to buy the bonds unless sold at a cut price of from 75 cents to 90 cents on the dollar.

These utility usury hounds have encouraged utility development in order to make rich profits. They assist in organizing holding companies, mergers and subsidiaries. They encourage pyramiding of stock issues, always accompanied by high cost of financing. Now the balloon is coming down—not at the cost of the Eastern Shylocks but at the terrible cost of fleeced investors.

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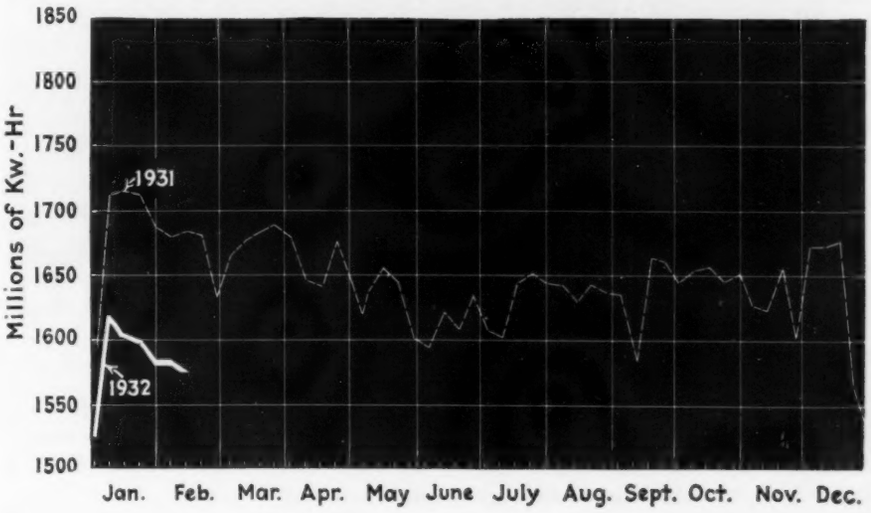
Output Running 6 per Cent Under 1931



ENERGY production of electric light and power plants during the week ended February 13 declined slightly from that of the preceding week, in accordance with the usual downward trend at this season of the year. Compared with 1931 the output was down 6.2 per cent, against 6.7 per cent five weeks ago, then 6.7, 5.8 and 5.2 per cent.

National and regional changes, as reported by the National Electric Light Association, are shown in the tables.

Weekly Output, Millions of Kw.-Hr.

	1932	1931	1930	1929
February 13	1,579	1,684	1,770	1,718
February 6	1,589	1,679	1,782	1,726
January 30	1,589	1,687	1,809	1,728
January 23	1,598	1,713	1,826	1,717
January 16	1,602	1,717	1,834	1,737
January 9	1 619	1,714	1,816	1,734

Per Cent Change from 1931

Region	Week Ended Feb. 13	Feb. 6	Jan. 30
Atlantic seaboard	—3.6	—1.1	—1.9
New England alone	—4.2	—2.3	—2.6
Central industrial	—9.7	—7.8	—8.7
Chicago district	—8.5	—3.5	—5.5
Pacific coast	—2.4	—5.5	—6.5

Industrial Activity Rose in January—Within 4 per Cent of 1931

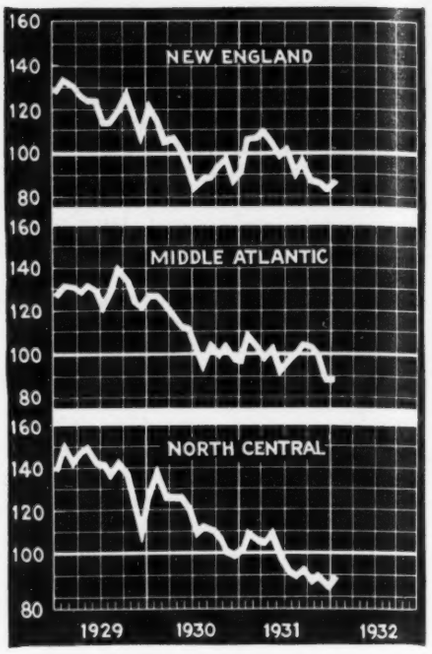
FOLLOWING a decline from November to December, the general average of industrial activity turned upward in January. The decline was a normal occurrence for the time of the year, but was sharper than usual. To make up, the January rise of 5.4 per cent over the December figure, or 4.8 points on the ELECTRICAL WORLD index, was proportionately greater than in 1929 or 1930 and contrasts with a decrease in 1931.

The curve continues under the preceding year's, but approaches it within 4 per cent. That is the nearest since the autumn of 1929. It may or may not indicate a turning point, but the evidence certainly points to a decreasing disparity between recent operations and those a year earlier.

Of individual industries that are moving upward the manufacture of automobiles, parts and accessories stands out conspicuously. The index has been mounting steadily from the low point last August. In five months the rate of activity has almost doubled. The usual early winter sag was completely absent. The January figure is 24 per cent higher than in 1931. No other industry shows so large a gain.

As was explained in the issue of February 14, 1931, on page 341, the industrial activity in this industry, as indicated by energy consumption, is not immediately reflected in the statistics of car output. It corresponds much more closely with employment and wages, for it takes into account the production of parts and accessories.

Other industries that are above their level at the beginning of 1931 are food products, textiles, chemical, rubber, and stone, clay and glass products. But the industries that depend for their prosperity on new construction remain in general at a low ebb. Iron and steel plants are down 25 per cent compared with January, 1931; metal-working is down nearly as much; the lumber products industry is off slightly. Stone, clay and glass, strongly influenced by cement manufacture, appear in a relatively favorable light, mainly because their January, 1931, figure was exceptionally low.

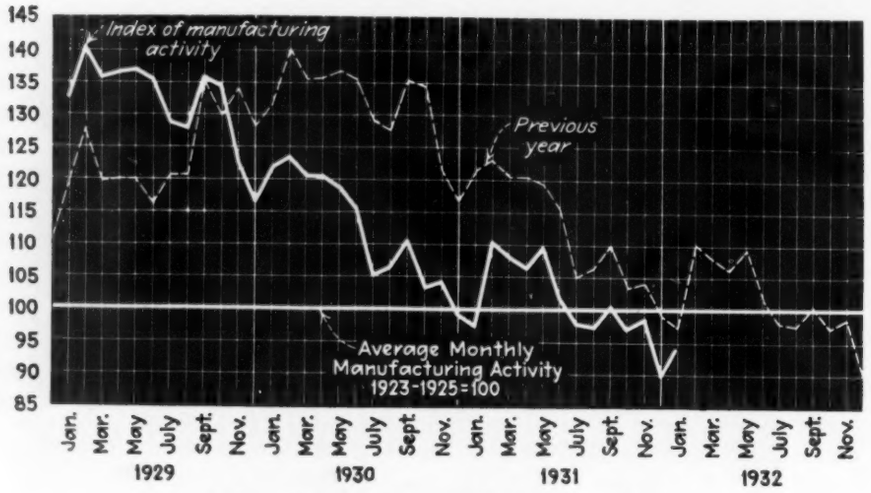


Index of activity in industrial areas

Regional comparisons for the eastern part of the country are presented in the table and the smaller charts. New England's average is nearly as high as a year ago. Her metal industries are down; rubber and paper increased. Textiles, after the activity in the first half of 1931, have receded and are 27 per cent below that year's maximum.

In the Middle Atlantic States the metals and stone groups, severely down from 1931, adversely affected the regional average. Lessened activity in North Central food products, metal and textile industries outweigh the gains in automobile manufacture, resulting in an average 10.7 per cent lower than in January, 1931.

The measure of industrial activity here used is the electrical energy consumption in numerous individual plants as reported to the ELECTRICAL WORLD.



Index of monthly manufacturing activity

(Corrected for number of working days, but not for seasonal variation) These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

Base Average Month, 1923-25 = 100

Industrial Groups	United States Jan., 1932	United States Dec., 1931	United States Nov., 1931	United States Jan., 1931	New England Jan., 1932	New England Jan., 1931	Middle Atlantic Jan., 1932	Middle Atlantic Jan., 1931	North Central Jan., 1932	North Central Jan., 1931
All Industry	**91.9**	**89.1***	**99.1***	**97.6**	**87.2**	**90.2**	**89.6**	**96.6**	**89.5**	**100.2**
Automobiles (including parts and accessories)	83.6	78.1	65.5	67.5	.....	.....	91.7	75.9	84.1	67.5
Chemical products (including oil refining)	134.3	118.2*	138.9	132.0	149.7	153.5	145.6	139.2	117.3	136.7
Food products	127.2	124.8	144.0	118.3	.....	.....	95.8	82.3	110.8	122.0
Iron and steel	77.6	70.0	77.0	103.4	94.0	123.8	73.0	90.5	76.2	103.8
Metal working	72.7	70.9	76.0	95.0	91.3	102.0	75.5	99.2	68.7	102.8
Leather products	67.6	79.2	75.2	71.6	86.2	72.6	88.7	77.6	69.5	60.0
Forest products	81.9	67.0	76.4	82.6	43.2	42.8	57.2	66.5	89.6	82.7
Paper and pulp	109.3	107.0	126.1	111.8	122.7	107.6	68.4	70.8	85.9	90.4
Rubber products	104.0	79.2	93.5	99.0	95.1	82.0	....	.....	113.4	109.6
Shipbuilding	93.2	94.6	95.0	113.9	.....	.....	.....	.....	.....	.....
Stone, clay and glass	77.1	76.8*	113.8	75.3	.....	.....	51.7	86.1	106.7	65.5
Textiles	87.8	89.8	93.4	86.4	65.6	75.2	102.0	102.6	109.2	124.1

*Revision.

Arrow-Hart & Hegeman Profits Reduced

Net profits of $250,713 after depreciation, taxes, inventory write-down and exchange losses are reported by the Arrow-Hart & Hegeman Electric Company for the year ended December 31, 1931. A reserve of $297,000 to cover the decline in value of marketable securities during 1931 was charged against surplus account. Net profits for the previous year were $522,529.

New Duties Affect British Electrical Imports

The "abnormal importations" act, which was passed last November, has effectively checked the rapid increase in the volume of certain electrical imports into Britain. The official returns for December show this very clearly. The items on which the "abnormality duty" has been imposed, together with the values of their imports in the last three months of 1931, are given in the following table:

Imports Into the United Kingdom

	October	November	December
Radio apparatus...	£237,000	£390,000	£57,000
Electric bulbs.....	45,000	97,000	28,000
Light fittings.....	73,400	94,700	42,000
Electric carbons....	24,500	42,400	26,700

Not only was there a marked decrease in all cases in the December import returns, but the actual figure for that month was appreciably below the corresponding monthly average of the first nine months of the year.

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Mill and Elevator Mutual Electrical Code Ready

The 1932 edition of the Mill and Elevator Mutual Electrical Code has just been issued. It is published by the Mutual Fire Prevention Bureau, Chicago. The code made its first appearance in 1909, having been developed to provide proper regulation for the installation of wiring and apparatus in mills. The present edition is based largely on requirements of the National Electrical Code, particularly Article 32, pertaining to hazardous locations.

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General Electric Pays Employees for Suggestions

A keener interest in learning to do their job a better way netted employees of the General Electric Company a total of $55,739 during 1931. The annual suggestion report of the company, just issued, reveals that 19,595 suggestions were made by employees during the past year, or an average of 428 suggestions for every thousand employees.

Of the total number of suggestions submitted during the year, 6,383 had sufficient merit to be adopted by the company, or an average of 139 for every thousand employees. During the year 32.6 per cent of the recommendations were acted upon favorably, as compared to 32.1 per cent in 1930.

The highest amount paid for a suggestion during the year was $1,000, which was awarded to an Erie (Pa.) employee. The average award per adopted suggestion was $8.75. The high award for 1930 was also $1,000, paid at the Schenectady works.

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Plan Aids Financing of Line Construction

PENDING a return to more receptive markets for new security issues than now exist, the Hoosier Engineering Company has devised and is offering to utilities a two-year financing plan to facilitate transmission line extensions. The plan is also designed to facilitate the buying of transmission or distribution equpiment necessary for immediate needs, or the purchase of which, at present low prices, is considered advisable for future needs.

The plan goes a step farther than ordinary methods of short-term construction financing. Normally the buyer issues two- or three-year collateral notes secured by bonds, debentures, etc. Stiff discounts on new issues offered in the current market, however, make borrowing less attractive than when a securities buyers' market existed. The Hoosier Engineering Company proposes to take such short-term notes of its clients in payment for the work it does and for the materials used in construction, and to place in escrow with the collateral securing the notes an amount of cash up to 10 per cent of the face value of the notes. By previous arrangement these notes will be distributed to the public through an established investment house. It is anticipated that this additional cash security will materially reduce the note discounts; in fact, will reduce them to levels not to exceed the average cost of this kind of financing under ordinary business conditions. The client is not restricted as to the purchase of materials, but, naturally, must give the construction job to the Hoosier Engineering Company. A number of transmission line material manufacturers have expressed their willingness to cooperate on the same basis as the Hoosier Engineering Company in the execution of the plan.

The term of two years anticipates that within that period suitable long-term financing can be arranged on an economical basis to provide for the retirement of the notes. The notes may be recalled before maturity on a small premium payment. The two-year term involves the speculation that industrial and security conditions will improve materially in that time. It is reasonable to suppose that the upturn in conditions will come rather slowly. If confidence in the upturn is general the present construction of profitable transmission line projects would seem highly advisable.

Major New Construction This Week

ELECTRIC power equipment to cost over $80,000 will be purchased by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for naval air station, Sunnyvale, Calif. Bids will soon be asked.

Heavy-duty motors, controls, panelboards and other industrial power equipment estimated to cost over $35,000 will be installed in the dry ice plant of the California Carbonic Ice Manufacturing Company, San Francisco, Calif. Total cost about $200,000.

More than $70,000 will be expended for electric power machinery and equipment for the proposed cement mill of the Edison Cement Company, Orange, N. J., in Raritan Township, N. J., where land and factory group are being purchased. Entire cost over $500,000.

About $100,000 will be invested in a hard-rubber manufacturing plant at Chester, W. Va., by C. A. Smith, Jr., Chester, and associates. All machinery will be electrically-operated and electric equipment installation will approximete $25,000.

Electric tools, motors, panelboards, controls and other electric power equipment will be installed in proposed engine house and repair shops at Klamath Falls, Ore., to be built by the Great Northern Railroad Company, St. Paul, Minn., at an estimated cost of $100,000.

More than $150,000 will be expended by the Verde River Irrigation & Power District, Phoenix, Ariz., for electric power equipment for an irrigation program on tract of 85,000 acres, including pole lines, wire and cable, power substation apparatus, electrically operated pumping machinery and accessories.

Proposed meat-packing plant of the Malden Products Company, Boston, Mass., at Malden, Mass., will require motors, controls, conveying, loading and other machinery, motor-driven refrigerating equipment, etc., to cost over $85,000.

Brighter Banking Outlook Steadies Copper Price

The attempt to bolster banking resources in this country had the peculiar effect of greatly increasing foreign demand for copper, while the domestic market remained quiet. Prices showed an upward tendency and foreign sales were about 20,000 long tons, having increased sharply in the past week. Prices continued firm.

	Feb. 10, 1932 Cents per Pound	Feb. 17, 1932 Cents per Pound
Copper, electrolytic....	6c.	6.25
Lead, Am. S. & R. price	3.75	3.75
Antimony.....	6¼	6¼
Nickel, ingot.....	35.00	35.00
Zinc, spots.....	3.15	3.175
Tin, Straits.....	21.40	22.25
Aluminum, 99 per cent.	23.30	23.30

Supreme Court to Settle Smith Case

Counsel filed with the Supreme Court of the United States on February 13 motions seeking to have the court decide the whole matter in controversy in the case involving the right of George Otis Smith to hold office as a member and chairman of the Federal Power Commission. They asked to have the case specially advanced for argument.

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Southeastern N.E.L.A. Alters Plan

C. M. Kilian, executive secretary of the Southeastern Division, N.E.L.A., announces that this body will not hold a convention this year but will substitute a two-day conference of delegates with no entertainment features.

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Utility Matters Lively in Borger

Controversy between the city of Borger, Tex., and the Panhandle Power & Light Company over electric light rates led the city to pass an ordinance reducing the rates and subsequently to grant a franchise without vote of the people for the installation of a competing service. The company replied by cutting off the street lamps because of unpaid bills, leaving the city in darkness, and it demands that the new franchise be submitted to popular vote. It is also proposed to vote on recall of the Mayor and City Commission.

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Tillamook Project Comes Up

No active support or opposition was in evidence at the conference of the Oregon Hydro-Electric Commission on the preliminary petitions for appropriation of water from the Trask River and the development of approximately 4,000 hp. in Tillamook County by the organization of a people's utility district. Some thought that the district should be formed if it is economically feasible for the residents to develop and distribute their own power. Others pointed out that a hydro development would seriously affect the lumber interest in Tillamook County, since the Mountain States Power Company, serving that territory, consumes hog fuel and timber waste from the sawmills. A final report on setting up the district is to be issued April 9.

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More Indiana Rate Happenings

Lafayette light and power users, as the outcome of long negotiations with the Public Service Company of Indiana, have gained a reduction in industrial and domestic rates amounting to $60,000 a year. Reduced rates for the municipal electric plant at Richmond have been established following an order from the Public Service Commission requiring an annual reduction of $100,000 in its earnings. The Madison City Council has unanimously declared revised rates of the Madison Light & Power Company to be discriminatory and unfair. A petition will ask the commission to review the case.

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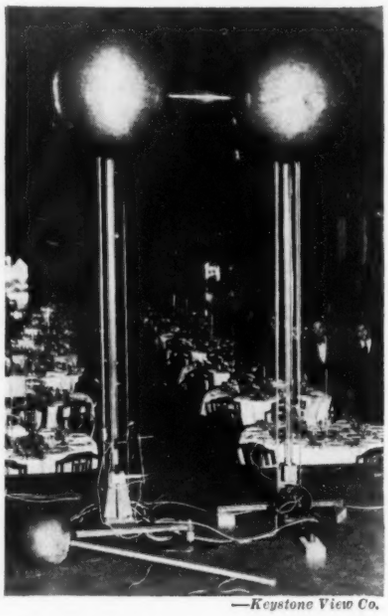
M.I.T. ALUMNI DINE WITH 1,500-KV. GENERATOR



—*Keystone View Co.*

Towering above the tables where former M.I.T. students met for their annual dinner this month was a 1,500,000-volt generator built by Dr. Robert J. de Graaff. An endless belt passing through two spheres and subjected to continuous brush discharge brought the potential to this value.

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St. Louis Utility Buys Two Plants

Conditional approval has been given by the Missouri Public Service Commission to the Union Electric Light & Power Company of St. Louis to acquire two generating stations from the St. Louis Public Service Company, a street railway utility, at a cost of $2,100,000. The street railway company must make a satisfactory contract for its requirements first.

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Engineers for Rate Cut in Denver

Engineers employed by the city of Denver to examine into the rate base of the Public Service Company of Colorado recommend a reduction of 7.7 per cent in the domestic rates and that the penalty for tardy payment be reduced from 10 to 5 per cent. The engineers value the company's property at $36,409,468 against the company's figure of $45,205,729.

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Purchased Energy for Church Plant

Far-reaching plans for the development of a publishing center by the Christian Science organization in the Back Bay of Boston involve the purchase of all the energy for this group of buildings from the Boston Edison company, proposals for isolated-plant construction having been rejected. An immediate increase of 300 kw. in connected load is contemplated. The existing supply is 400 kw.

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Electronic Music Interests A.I.E.E.

Musical possibilities of electrical oscillations will be demonstrated at an evening meeting of the A.I.E.E. in New York on February 26. The theory of this art, its present state and its future will be discussed, and the electronic organ piano, the ranger tone electric organ and three of Professor Theremin's devices will be demonstrated. Dr. Walter Damrosch, who, as well as Leopold Stokowski and other eminent musicians, is interested in the new music, will speak.

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Hoover Portrait for Founder Bodies

A large portrait of President Hoover was unveiled on February 15 at a meeting of the United Engineering trustees in the Engineering Societies Building, New York. The President sat for this portrait in response to a request from the four national engineering societies of civil, mining and metallurgical, mechanical and electrical engineers. He was formerly president of the American Institute of Mining and Metallurgical Engineers. This portrait was painted by Philip A. de Laszlo. Gano Dunn, former president A.I.E.E., delivered the portrait with an appreciative statement.

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Breaker Explodes, Service Goes On

Mechanical failure of some structural part is the early diagnosis of the cause for a circuit-breaker explosion followed by an obstinate oil fire that occurred in the 132-kv. switching structure at the Waukegan station of the Public Service Company of Northern Illinois on February 16. The trouble put one of the southgoing 132-kv. lines out of commission but caused no actual service interruption because of the prompt functioning of relays and the existence of parallel lines in the territory served. The explosion occurred while the equipment was at rest, no switching or other operations being in process.

Electrical Men Join Move for Noise Measurements

"Preparation of general standards of nomenclature, units, scales and measurement in the field of acoustics, with special reference to noise measurements," is the definition officially given of the scope of the work of a sectional committee on noise measurement to function under the technical leadership of the Acoustical Society of America. Organization of this committee under the procedure of the American Standards Association was recommended at a general conference recently held at which 32 representatives of 18 national bodies were present.

The object in view is to correlate the activities of various technical and trade organizations which have been attempting individually to set up standards for noise measurement. Eight such organizations now have committees on this subject, which has given rise to discussions at recent meetings of the American Institute of Electrical Engineers. That body was represented at the conference first referred to, as were the electric light and power utilities, the N.E.M.A., the N.E.L.A., the Association of Edison Illuminating Companies, the fan manufacturers, communication engineers and others in whose activities or products noise accompanying the use of electricity is an element.

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Water-Type Breakers Used in 11-Kv. Service

Progress achieved in the development of circuit breakers utilizing water or steam in place of oil has been so rapid abroad that in the extension to the Wuppertal power station of the Corporation of Barmen, Germany, just completed, this type of breaker has been adopted for regular service.

The installation consists of ten breakers, each rated for a carrying capacity of 350 amp. at 11 kv., but with a rupturing capacity of 15,000 amp. It is claimed that the use of water in this type of breaker causes the gas evolved when the contacts are separated to be completely deionized before the recovery voltage reaches a value at which an arc could be maintained or struck.

The underlying principle is that the steam generated due to the formation of the arc under water expands adiabatically and, becoming saturated, instantaneously condenses. Owing to the saturated state of the steam, the molecules are closely packed, in consequence of which the free electrons in the arc space, being within the radius of attraction of the molecules, are immediately neutralized and the arc space becomes deionized. A feature of the expansion breaker is, therefore, the remarkable freedom from burned and pitted contacts.

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Heat-Pump Efficiency Is High in California Building

After several months of operation the reversed refrigeration cycle used for the heating of the thirteen-story office building of the Southern California Edison Company, Los Angeles, Calif., is reported by the engineers of that organization to have fulfilled all expectations and to indicate a great future for this latest step in providing complete air conditioning in office and commercial buildings.

The heat pump or reversed refrigeration cycle for the delivery of heat was first suggested by Lord Kelvin 75 years ago, has been introduced by T. G. N. Haldane in some pioneering installations in England (see page 315, August 15, 1930, ELECTRICAL WORLD), and while widely discussed for possible introduction in this country it was first tried out on a large scale in the new Southern California Edison Building.

Operation up to the middle of this winter shows that for every kilowatt-hour expended in the system the equivalent of 2.1 kw.-hr. has been liberated in the form of useful heat in the building. If a heater had been installed in the lower ventilating system and the capacity of the refrigeration equipment thus more fully used, this figure, it is estimated, would have been about 2.8 kw.-hr.

Mercury Vapor Reduces Contact Resistance

As the result of careful investigations aimed to disclose the reasons for the reduced contact resistance observed when carbon brushes operate on brass rings in an atmosphere of hydrogen, Westinghouse engineers announce the unearthing of some interesting facts.

Three conclusions reached are (1) that the atmosphere surrounding a contact, whether it be at atmospheric pressure or at a pressure as low as 50 microns, has little effect on the electrical characteristic of the contact; (2) that a small amount of mercury vapor in a non-oxidizing atmosphere around a sliding contact will result in a very low contact drop, and (3) that the change in the contact with the introduction of mercury vapor is such as to make it behave like a constant ohmic resistance.

In an investigation conducted by R. M. Baker of Westinghouse a drop of less than 0.02 volt was found. The mercury vapor in the case of machinery operating in an artificial atmosphere was unintentionally introduced by vaporization of the mercury seal used to maintain the non-oxidizing atmosphere.

The commercial application of this information has not yet been made, but Mr. Baker anticipates the possibility of such a development. The increased operating efficiencies possible might involve some notable changes, both in design and installation in certain rotating equipment.

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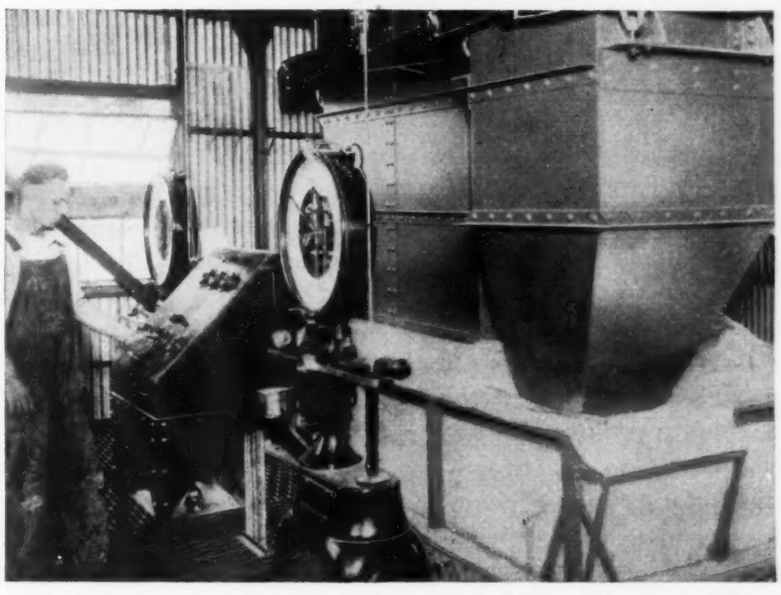
PHOTO TUBE WEIGHS INGREDIENTS FOR CONCRETE



Toledo Scales Company equipment at the works of the Cranford Company, Brooklyn, N. Y., adapts a General Electric photo-electric tube to the proportioning by weight of concrete aggregates. Each material used requires a separate beam on the front of the gage. When the beam rises the relay is actuated and the feed is cut off.

EDITORIALS

L.W.W.MORROW
Editor

Unwise penny pinching

EXPENSE cutting can be carried to an extreme if a true perspective is lost. Financial pressure of immediate moment should not jeopardize the progress of the industry or result in ultimate costs far greater than the immediate savings.

For example, the wholesale discharge of engineers by utilities and manufacturers because of business stagnation is a bad policy. It creates immediate competition and destroys the morale of those still employed. Beyond this it jeopardizes the industry's advance, for this rests upon engineering developments.

Another example of ill-advised economy is a saving in expenses for contacts with and services to customers. Fuse renewals, appliance repairs, "home service" girls and many other items seemingly are expensive and can be eliminated. As a matter of fact, these are essential as never before. They give true public relations returns and a service that the customer values beyond mere money. The utility business can be successful only in the degree to which it has the faith and confidence of its customers, and this is obtained only by personal contacts. Here is the major executive reason for home services, especially in this period when the customer is in a depressed and disgruntled mood. Even the rigid enforcement of rules for delinquent bills should be considered from the point of view of the customer and with good public relations in mind instead of pounds of flesh.

This is not a time for penny pinching on aspects of the business that are necessary and fundamental, yet financial pressure is so great that evidence is found in many parts of the country that unwise economies are being instituted. They should be checked and stopped.

Harold Babbitt Smith

BY THE death of Dr. Smith last week the electrical engineering profession has been bereft of a pioneer investigator of solid dielectrics and high-voltage phenomena whose researches began nearly forty years ago. His departure removes from the field of electrical technology an educator of high repute, one singularly capable of inspiring in young men the insatiable curiosity which lures them into the "quest of the unknown" —his own favorite theme.

Always a hard worker in the affairs of the American Institute of Electrical Engineers, he rose through the directorship and a vice-presidency to the presidency in 1929. He was then privileged to see the fruition of his long efforts to bring the Institute to the members by enlarged and co-ordinated activities of the branch, section and district. As the years go on the timely decentralization which he more than any one else effected will be remembered as his foremost contribution to the Institute and to the profession. Meanwhile his many other services to engineering advance and professional good citizenship fully confirmed the rank accorded him by his colleagues. From men like him comes the altruism which lifts applied electricity high in the estimation not only of its devotees but also of those who profit by its availability.

Load-factor business needs no capital

BACK in 1922 the use factor of utility generating stations was 38; in 1927 it had decreased to 35.5 and in 1931 to 31.6. In nine years the output grew from 47,000,000,000 to 92,000,000,000 kilowatt-hours and the generating capacity

from 14,000,000 to 33,000,000 kilowatts—an enormous growth. But the hours' use per year of the generating capacity decreased about 6.5 per cent.

Generating-station equipment is idle 70 per cent of the time. New capital for expanding usual services is difficult to obtain. Many unexploited load-factor services exist that require no added facilities and no new capital. Logic as well as opportunity points toward the development of classes of business that will improve load factor. Concentrated attention can be given to this activity by commercial departments to the dollar advantage of the industry.

Industrial establishments are on low production levels, and perhaps a rate inducement would change their working hours with a consequent immediate saving to both manufacturer and utility. It might bring a permanent shift in working habits. Even the little electric clock brings in about $4,000,000 a year and works twenty-four hours a day with a supply equal to one 10,000-kw. generator. Water heating, air conditioning, street lighting, floodlighting, home lighting, industrial electric heat, electrochemical processes—there are many services undeveloped or unsold that would improve load factor. Why not turn engineering as well as commercial departments loose on each property to get this kind of business?

Invest a dehoarded dollar —and spend one

WITHOUT a doubt the drive against hoarding instituted by President Hoover will be more effective than any of the other measures so far applied to turn blue into rose—more effective because its mechanism is the only one aimed straight at the individual. Its effective results will convince the individual that he alone, not some mysterious credit magic, governs his economic salvation. With that lesson taught, confidence should grow heartily.

One suggestion should receive consideration. The announced intention is to get the hoarder to invest his secreted savings or restore them to the banks. Why not assume that he has a third dollar and ask him to spend it for something he has needed for some time? In other words, to induce the full circulation of currency the anti-hoarding drive could well be accompanied by a drive to bring a resumption of spending. That prices are low and may not go lower is one effective argument. Some persons, too, would part with a dollar more quickly in return for something useful than invest it, pay it in taxes or even give for unemployment relief. A dollar in circulation is just as effective in the retail-wholesale channels as it is in the bank, in good securities or in the tax coffers.

An indirect aid to the work of farm demonstrators

A COMPREHENSIVE summary of the latest available information on more than a hundred rural uses of electricity has recently been issued by the Committee on the Relation of Electricity to Agriculture under the title "Electricity on the Farm." Containing 332 pages of valuable information supplemented by 570 illustrations, 87 charts and 160 tables, it is needless to say that a copy should be in the hands of every person trying to interest farmers in the installation of electricity. But it is possible that another and probably more valuable use will be overlooked—that is, the distribution of the publication among farmers who are already on electric service lines but who must be induced to apply electricity more extensively if they are to receive the maximum economy from it.

Presented in attractive form as it is, it does not seem unreasonable to believe that farmers would be glad without any urging to read it from cover to cover and even to keep it as a reference book. Farmers possess to a greater degree than urban people a dislike to being forced into purchasing anything. They like to have all the facts and ponder over them—to "sell" themselves, in other words. They have fewer distractions on winter nights than the city dwellers and might voluntarily read and study such an interesting compilation.

If every farm demonstrator for a utility company and every farm salesman for manufacturers or dealers carried such a book with him, gave his prospective customer a glimpse of it and offered to send a copy upon request, it is doubtful whether there would be any waste circulation. Furthermore, the cost of distributing these booklets in quantities is surely a very inexpensive way of in-

directly creating a desire for greater use of electrical applications.

The book comes about as near to having the intriguing points of the best mail-order catalogs—which have developed so much farm business—as anything on this subject has done so far. It contains most of the desire-creating elements and goes further by showing definitely what can be accomplished with the applications discussed, how much benefit will be derived and what costs will be incurred.

Dielectric research progresses

IN THE session devoted to research at the winter convention of the American Institute of Electrical Engineers two papers in the field of dielectrics and insulation served to call attention to progress which advances knowledge as to the nature of the underlying processes involved in the behavior of dielectrics as insulators. One of the papers discussed the phenomenon of dielectric absorption or residual charge and its influence on the losses in dielectrics resulting from alternating stress.

It was shown in convincing fashion that it is possible to predict completely the alternating-current behavior if the short time charge and discharge curves, under continuous potential, are known. Experimental methods were described for the taking of such curves. In the discussion it was brought out that these results indicate that dielectric loss is linked with dielectric absorption, which means that the loss is a pure ohmic loss in most cases, although at high frequencies the orientation of polar molecules may be a contributing factor. This is a distinct advance from days not so long past when dielectric losses were frequently referred to as being of the nature of hysteresis, as in magnetic materials. These statements, however, were never backed by exact knowledge and frequently were only another way of expressing ignorance of the subject.

The second paper had to do with the ever-interesting subject of dielectric breakdown. Both in the paper and in the discussion it was evident that we have now reached a point where it is definitely known that under a sufficiently high value of voltage dielectrics will fail instantaneously, and at values of stress which are independent of the thickness of the sample and of the temperature over a considerable range. This is known as the pure electric breakdown. It is also recognized that the so-called thermal type of failure results from relatively low values of stress, applied over long periods of time during which the body of the insulation becomes heated by internal losses, resulting in high internal temperatures, increased local conductivity, secondary ionization and ultimate failure. These two types or failure are, therefore, quite different as to their ultimate nature. Failures of the first kind require voltage gradients far in excess of those in practice.

Most of the failures met in practice are of the second type, and studies of this character have brought out the importance of internal temperatures and the necessity for providing against them in design. The paper referred to presented evidence which the authors felt indicated a third type of failure, lying between the other two and obeying a regular law. In the discussion which followed the general opinion appeared to be that this claim was not completely warranted and that the apparent intermediate type of failure represented uncontrollable physical conditions between the regions of low-temperature electric breakdown and the high-temperature thermal breakdown on sustained stress.

An endowed history of electrical engineering

AT THE winter meeting of the A.I.E.E. President C. E. Skinner suggested that an authoritative history be written about electrical men and electrical developments in this country. Many pioneers still live to make first-hand information possible, and experience indicates that careful investigation is needed to fix dates of invention and individual contributions definitely. This task is of great difficulty. It requires an author with a glowing pen if he is not to produce a dry tome of little sustained interest or romance. But no more valuable or worth-while suggestion could be made, and, since this is not a commercial project, it is to be hoped that a committee will be organized to produce the endowment and select the author to do the work. Records are very incomplete and time is passing. This undertaking should be started at once.

Robert J. Graf

A BYLLESBY man ever since H. M. Byllesby & Company was founded in 1902, at which time he joined the organization at the age of twenty as secretary and assistant treasurer, Robert J. Graf has justified the choice for this post of so young an individual by the steady progress he has made in the executive ranks of the great utility firm. In fact, he may be said to have grown with the business to which his entire career has been devoted. In 1914 he was elected vice-president of the company, and in 1924, following the death of Colonel Byllesby, he became its first vice-president. He holds the same office in the Byllesby Engineering & Management Corporation and is an executive or director of the Standard Gas & Electric Company, the Standard Power & Light Corporation and their subsidiary and affiliated companies. He was until quite recently president of the San Diego (Calif.) Consolidated Gas & Electric Company.

Mr. Graf was born in 1882 in Washington, D. C., and was educated in the common and preparatory schools of that city. He is a member of the American Institute of Electrical Engineers and of the National Electric Light Association as well as of numerous technical, social, athletic and educational societies and clubs in Chicago, where he lives; New York and elsewhere.

The Holding Company at the Crossroads

By H. M. CAMERON
Financial Editor ELECTRICAL WORLD

IS THE utility merger movement completed? Will control in the industry tend to concentrate further or is a degree of decentralization on the horizon? What will determine the future trend of utility development along these lines? The depression has provided a testing ground for many of our economic institutions. The prospect of a return to more active business strongly suggests an introspective study in an attempt to determine the part to be played by the utilities, especially the holding companies, and the probable course of their development in the next two or three years.

When the tide of business turned downward in 1929 the concentration movement which had flourished in the utility field for more than a decade was suddenly and irresistibly checked. Large projected mergers and regroupings were postponed indefinitely. Two and a half years later, although operating utility earnings have almost maintained their peak levels, the effect on holding company earnings has been quite noticeable. The merger movement has not been resumed and holding company financing is virtually at a standstill. What will be the nature of marketing conditions for senior holding company securities in the next two years is still problematical.

Whether or not these projected mergers and regroupings, especially under banking initiative, will be resumed, and whether or not the holding company will resume its position as a major vehicle in utility finance, depends on the trend of three or four important developments of the next two or three years. The alternative is a gradual increase in operating company financing and a more or less definite limitation of the executive functions formerly assumed by the holding company. There is nothing on the horizon to suggest any great changes, except some decentralization, in those companies which have made themselves indispensable and have been built permanently into the utility structure of the nation. There is a type of holding company, however, which, conceivably, may shift its emphasis from a position of control to one of acquiring carefully chosen minorities. Such companies would thus assume the function more of the investment trust with a greater community of interest among the group whose shares they hold than is now the case with the typical investment trust. In this event the emphasis would be shifted, to a degree at least, from service to the borrower to service to the lender of funds.

Factors suggesting change

What are the factors to be watched in any attempted estimate of future trends? Some current developments of interest are:

1. A critical attitude on the part of the larger institutional investors.

2. Launching of the third major governmental investigation into holding company functions and methods.

3. Less need for the diversity effect of grouped properties to stabilize earnings and help credit for financing.

4. Radical depreciation of securities held in portfolios of holding companies and consequent market depreciation of their own securities.

5. Virtual completion of physical interconnection—the ultimate "raison d'être" of the holding company.

6. Inability of holding companies to finance in existing markets any better than or as well as operating companies.

There is no assumption or hint in all this that the holding company, as now constituted, has not performed a most useful and important function. No one familiar with utility growth during the past decade would deny that holding companies have been very largely responsible for the rapid growth and expansion of one of the nation's leading industries. But since the middle of 1929 the utilities, along with many other major industries, have been passing through a rigid testing period. The various types of holding company are having and will continue to have an opportunity to prove their worth; to demonstrate their economic value to society. No institution that cannot present such evidence is permanent. Demands upon the power and light industry for expanding service were never greater than they are today.

A prospective consequence of any decentralization movement is the return of local personnel to the directorates of operating companies. In many cases this important factor in public relations was lost with the merger movement. If local company financing should increase in the next two years, it virtually assumes the rebuilding of local boards in those cases in which direction has ceased to be local.

What are these demands, and what are they likely to embrace over the next four or five years? Current capital requirements involving a minimum of expansion are around $1,500,000,000 annually. This covers construction and refunding needs. It is probable that another $500,000,000 in short-term loans will have to be met largely this year. During the past decade the industry has raised $14,000,000,000, and of this 63 per cent is in senior securities. Latterly, bond financing has been dominant. This was due to various factors, such as ease of borrowing, eligibility of this type of security for trust investment, preference of bankers for bond flotations, instability of stocks, etc.

But it is probable that the companies will want to sell relatively more stock in the future to offset the amount of borrowing they have chosen to, or have had to, do. Sales of preferred stock to customers will take care of part of this, and a very important part, but not all. It is

not improbable that a trend will develop in the direction of introducing additional safeguards in equity securities sufficient to attract the attention of institutional investors. In any event, most of the safeguards of senior issues apply also to junior or unsecured obligations. The prime consideration in determining the attractiveness of a mortgage bond is whether or not the company involved has sound, honest and intelligent management. The same test is made in determining the value of a common stock. That capitalization should not exceed the value of property, including intangibles, and that the company should set up adequate reserves for maintenance, depreciation and contingencies, out of earnings, is demanded, whether a stock or a bond is being examined. Under regulation and with the use of no-par stock any opportunity for promotional profits which might have once existed is virtually negligible. When these precautions have been observed the long-term holder of equities is taking little risk. It will be more and more essential, if this trend is in prospect, that the utilities be allowed to earn a rate of return sufficient to pay the higher yield which stockholders require in order that an adequate proportion of stock can be built into the capital structures of the utilities.

Direction of expansion

With regard to the volume of capital requirements for the next few years, it is highly probable that present annual totals, at least, will be needed. That the merger movement and the interconnection process are pretty well completed does not mean that expansion has stopped or has even slowed down. A modern station can now be built for from $65 to $75 a kilowatt to operate at about 12,000 B.t.u. Stations even five years old cost $100 to $140 per kilowatt and operate at 16,000 B.t.u. Many of these are now obsolete economically. Balance sheet analysis of properties shows that rebuilding will frequently earn money on the old as well as the new capital. Furthermore, the industrial market for electrification is only about one-third saturated and can be developed aggressively. Railroad electrification, industrial heating, home cooking, air conditioning are but a few infants whose growth involves an increasing rate of expansion electrically.

It is the ability of the holding company to take a position of leadership in these directions, as well as in proving its superiority as a financing vehicle, that will determine its future. Its functions as a consultant on policy, in purchasing, etc., are thoroughly established. If the financing function cannot be proved in the next year or two the process must inevitably revert largely to the operating units.

Whether or not some of the functions of some companies may be modified, it seems a safe assumption that the sound, well-established holding companies will emerge from the depression better equipped to carry on the 1930-40 electrical development of the nation even than they have been in the past. Reorganization of certain of the smaller and weaker companies is already in process. Values in some cases may have to be written down. Some, as already indicated, may tend toward further emphasis of the investment trust function, rendering a service primarily to the investor and secondarily to the utility, assembling and thus diversifying a group of sound securities, both senior and junior, without any intention of acquiring majorities and dominating situations. Such a diversifying and clarifying of function, and lack of interference in actual operation where such interference is not warranted, would help greatly in solving the political problem.

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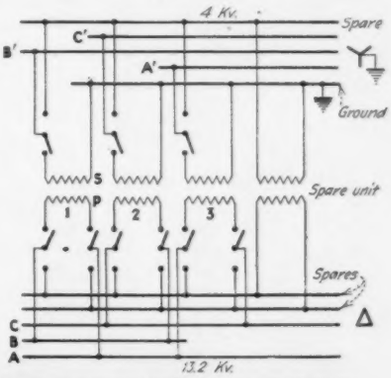
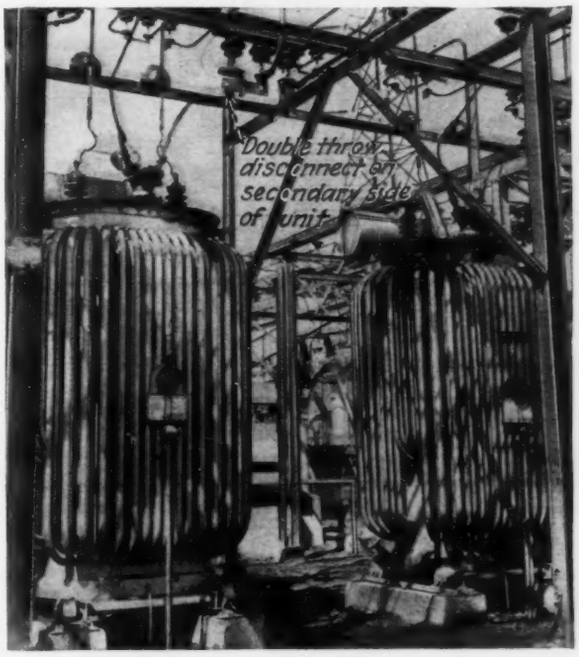
Simple Switching for Spare Transformer

Space is economized and material conserved at the Menands substation of the Niagara-Hudson Corporation by permanently connecting a 2,000-kva. spare single-phase transformer to primary and secondary spare buses as shown, and providing double-throw disconnecting switches to facilitate quick substitution of the spare unit for any one of the three in the operating bank in case of trouble. The units are connected with primaries in delta and secondaries in star, with grounded neutral. In normal operation trasformers 1, 2 and 3 are connected in service with the double-throw primary disconnects up and the double-throw secondary disconnects down. In an emergency requiring the removal of one unit of the bank from service the secondary disconnecting switch of the affected unit is thrown up and the primary disconnects on this unit thrown down, isolating the unit and substituting the spare transformer.

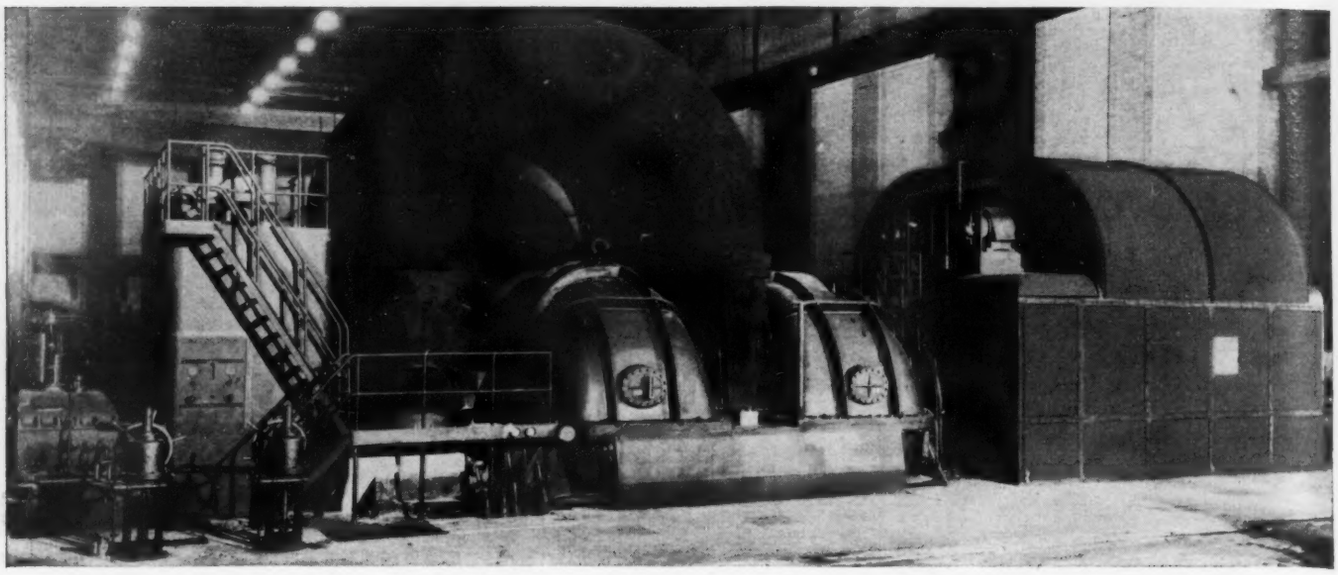


Switching at point of completion for normal operation



Reversing primary and secondary disconnects on any unit substitute spare

Brooklyn 160,000-Kw. Unit Placed in



- Single-shaft unit generates at 16,500 volts.
- Each low-pressure stage drained of condensate.
- 101,000 sq.ft. single pass condenser used.
- Boilers operate at 440 lb., 750 deg. F.
- Flexible drive used for stokers.
- Vane control for fans.
- Effective cinder catcher developed.

WHAT is claimed to be the largest single-shaft turbo-generator in the world was first turned over in the Hudson Avenue station of the Brooklyn Edison Company January 7 and put in commercial operation the last part of the month. The machine, designated as unit No. 7, is rated at 160,000 kw., 80 per cent power factor, 16,500 volts, and was built by the General Electric Company. The steam end consists of two cylinders, the high pressure operating at 400 lb. per square inch gage and the low pressure at from 3 to 13.4 lb. square inch absolute, depending on the load. At full load the high-pressure cylinder develops 120,000 of the 160,000 kw. There are eight governing valves and five valve points, the primary, quaternary and quinary being in pairs. The high-pressure cylinder has fifteen stages and is bled from two points, one located between the eleventh and twelfth stages at a pressure varying from 11 lb. to 49 lb. per square inch absolute, and one at the exhaust end at a pressure varying from 3 lb. to 13.4 lb. per square inch absolute over the operating range.

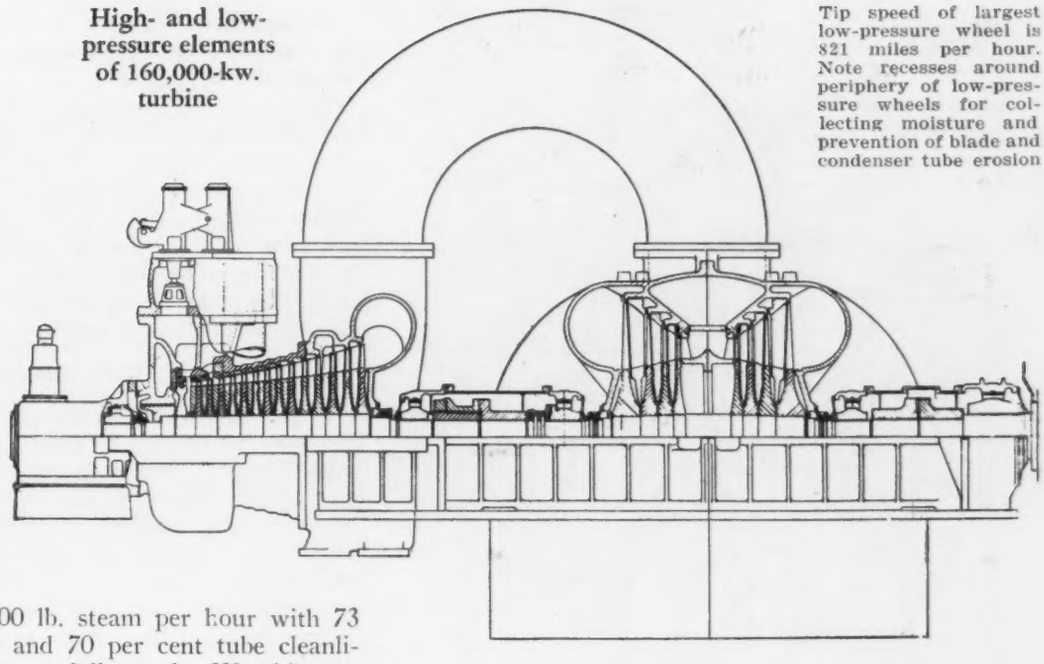
The low-pressure unit is of the double-flow design with four stages in each end. The last wheel has a diameter of 12 ft. 9½ in. and a tip speed of 1,205 ft. per second, or 821 miles per hour. The blades are of "Ascolloy," those in the last stage being 39 in. long. For the first time in turbine design special provisions have been made to drain moisture from every stage of the low-pressure cylinder in an attempt to reduce the blade and condenser tube erosion. The recesses which collect the moisture thrown out by centrifugal force drain to the condenser. An attempt will be made to determine the effectiveness of the drains during the acceptance tests by measuring the quantity of water removed.

To obtain a heat balance the condensate leaving the hotwell is pumped by the main condensate pumps through the air-ejector condensers, the generator air coolers and low-pressure heater in the order named. At the discharge of the low-pressure heater the boiler feed pumps raise the pressure to 600 lb. and pass the water through the high-pressure heater and economizer to the boiler drum. The condensate from the high-pressure heater is passed through a trap and flashed into the low-pressure heater to be condensed with the low-pressure heater steam and passed to the heater condensate pumps, which lift the water to the boiler feed pump section pressure. The heat balance diagram is shown on the next page.

Because of the space requirements for condenser tube withdrawal the generator air coolers had to be located above the floor on the sides of the generator frame. Instruments are mounted on the outside of the casing to indicate the temperature of the ventilating fan bearings, which are inaccessible when the machine is in operation.

ed in Service

High- and low-pressure elements of 160,000-kw. turbine

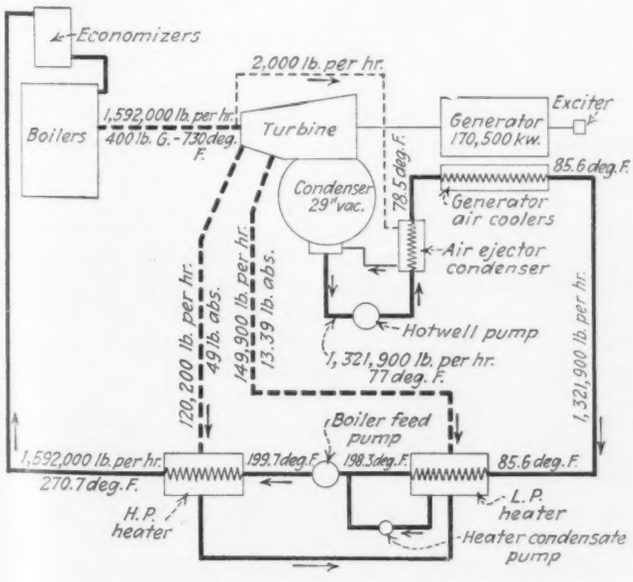


Tip speed of largest low-pressure wheel is 821 miles per hour. Note recesses around periphery of low-pressure wheels for collecting moisture and prevention of blade and condenser tube erosion

The condenser was built by the Worthington company and is said to be the largest single-shell, single-pass condenser in operation. The condensing surface area is 101,000 sq.ft. and is designed to maintain 27¾ in. vacuum when condensing 1,320,000 lb. steam per hour with 73 deg. F. circulating water and 70 per cent tube cleanliness. The tube sheet layout follows the Worthington "folded layer" design. The unit contains approximately 84 miles of tubing, made up of 14,710 30-ft. ⅞-in. outside diameter Admiralty tubes. The tube sheets, tube support plates and internal baffles are of Muntz metal. Air is taken off through two 10-in. connections, one in each side of the shell, to a precooler, and then through two stages of ejection to atmosphere.

Each of the two circulating pumps will deliver 73,000 g.p.m. at a maximum speed of 220 r.p.m. and is driven by a two-speed 225/164-r.p.m. motor rated at 600 hp. at the higher speed.

The four boilers which serve the unit were constructed by the Combustion Engineering Corporation and are fired by the longest stokers in the world. Each boiler, superheater and economizer unit is designed to deliver 530,000 lb. per hour at 750 deg. total temperature and 440 lb. pressure. The boiler proper is of the three-drum, bent-tube type, containing 24,450 sq.ft. of heating surface, comprised of approximately 1,000 3-in. tubes. A fourth, or dry drum, is used as a moisture separator, through which all saturated steam must pass before entering the superheater. The latter is of the Elesco hairpin type and has 5,740 sq.ft. of surface. The elements are cantilevered from the superheater headers and pass into the furnace between the front water wall tubes and then into and between the first bank of boiler tubes.



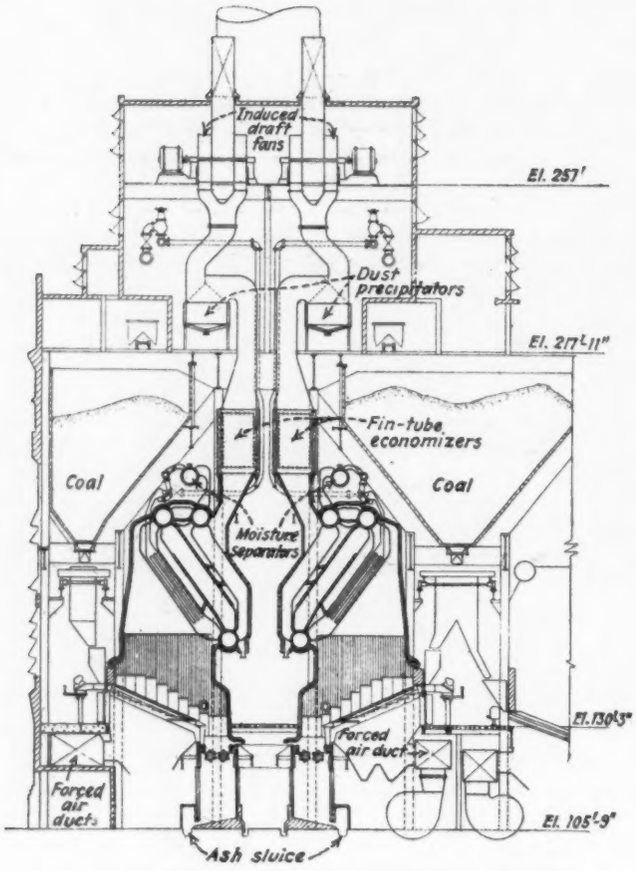
Heat balance diagram

The water walls have 3,846 sq.ft. of surface, the greater part of which is comprised of 4-in. finned tubes. Along the stoker fire line on the side wall tubes and on the bridge wall at the ashpit cast-iron blocks are cast onto the tubes to protect them from erosion. The insulation back of the furnace water-wall tubes consists of fire clay tile, 2½-in. blocks of high temperature insulation, 3 in. of rock wool and ½ in. transite panels. The only brick in the furnace is in the side walls above the side water-wall header and in the small section at the head of the stoker, where carborundum is used to help maintain ignition. The side wall brick is well protected by the water-wall risers which are inside the furnace and against the brick. The furnace has a volume of 14,000 cu.ft.

Located above each boiler is an economizer with 22,400 sq.ft. of heating surface. The water connections are such as to produce a counter-flow arrangement. At full load the feedwater temperature will be raised 115 deg. with a water pressure drop of 55 lb. The draft loss on the gas side will be 5.5 in. water pressure.

Each stoker is capable of burning 57,000 lb. of coal per hour for a period of two hours. This corresponds to a combustion rate of 82 lb. per square foot per hour. Each stoker is of the underfeed type and is fifteen retorts wide and 69 tuyères in length. The projected area is 694 sq.ft.

The external appearance of the stoker is quite different from previous types in that the great length of the unit and the number of secondary rams cause the driving mechanism to be set relatively high above the floor line (6 ft.) in order that the clinker grinder rolls may be set at the proper depth to give good vision of the ashpit from the boiler room floor. There are six secondary



Each boiler is capable of generating 530,000 lb. of steam per hour

Each stoker can burn 57,000 lb. coal per hour for two hours. Note fourth or dry drum above each boiler used as moisture separator, hairpin superheaters, ash sluices and cinder catchers. Hydraulic drive for stokers is 6 ft. above floor.

rams for each of the fifteen retorts. In order to develop a pleasing appearance in front of the stokers the boiler control panels were designed to extend the entire width of the stoker, with the boiler operating instruments grouped in the center. Advantage was taken of the inspection walkway immediately above the panel for concealed lighting. Access to the secondary ram stroke adjustment rods is gained from the ends of the panels.

Up to the time of installing units No. 7 the practice had been to use direct-current motors which received their supply from motor-generator sets. Control of speed is partly automatic in that the combustion control varies the d.c. voltage from the motor-generator sets. The stoker attendant can superimpose speed adjustment on top of the automatic adjustment by manually controlling a rheostat in the armature circuit of the motor at each stoker panel. This elaborate speed control has been used because of the wide range and practically infinite number of speeds afforded by it. For the No. 7 unit a Hele-Shaw hydraulic drive is used. A constant-speed squirrel-cage motor drives a variable displacement radial oil pump, the discharge from which flows at pressures varying from 400 to 800 lb. to a similar radial hydraulic motor unit mechanically connected to the main stoker driveshaft. An electric pilot motor regulated by automatic combustion control is used to vary the position of the cylinder block in the pump, and thus change the oil displacement and speed of the hydraulic motor.

When the ash passes through the clinker grinder rolls it drops into a sealed brick-lined storage hopper. To empty the hopper and deliver the ash to the pit on the wharf an Allen-Sherman-Hoff high-pressure sluice system is used. One of three hydraulically operated vertical gates is opened at a time and the feed plate located at the bottom of the hopper is swept by a movable jet, water leaving the jet at 100 lb. pressure. The ash and water tumble into the main sluice trench and are ejected to the sump by high-pressure nozzles located at intervals in the trench. A locomotive crane loads the material into scows from the sump.

Vane control on fans

Each forced-draft fan pumps into a trunk and is designed to deliver 200,000 c.f.m. against a static pressure of 10 in. and is driven by a 500-hp. motor. Each stoker connection to the duct has a damper which is automatically operated to compensate for variations in fuel bed thickness and pressure loss along the duct. Air discharge from the fans is regulated without changing their speed, which is maintained at 870 r.p.m. This is accomplished by adjustable vanes mounted around the fan inlet and operated by the automatic combustion control. As the opening of the vanes is varied the rotative speed of the incoming air with respect to the rotor speed is varied, causing a change in the fan pressure, volume, horsepower and efficiency characteristics. This method of control is far more efficient than throttling with a discharge damper, and when initial investment is considered G. L. Knight, Brooklyn Edison Company, declares it to be superior to adjustable-speed control involving a motor-generator set and exciter control or even wound-rotor or brush-shifting motors.

For induced draft each boiler unit has two fans, each of which at full speed will deliver 155,000 c.f.m. against 20-in. static pressure. The motors are rated at 1,000 hp. each. Each motor has three windings to give speeds of 1,160, 870 and 580 r.p.m. Volume control at each speed is accomplished by vane control.

Cinder catchers are used in each of the new boiler uptakes, the design of which was developed jointly by the operating and mechanical engineers' departments. After very exhaustive tests it has been shown to be more efficient and no more costly than any apparatus available. The apparatus consists of a large cast-iron hopper filled with salt water, above which are alternate $1\frac{1}{4}$-in. and $3\frac{3}{4}$-in. gas inlet and outlet passages. The narrow gas inlet passages produce a series of high-velocity jets which project the cinder into the water. The gas velocity drops after leaving the water surface due to the larger outlet passages and further separation of cinder from the gas takes place. Because of the high inlet gas velocity considerable wave action is produced on the water surface. This is minimized by a series of splash plates which run lengthwise of the hopper and project above and below the water line. After considerable experimenting and service trials with many materials ebony asbestos has been selected for the splash plates. Cast iron or steel does not last six months in this service, being attacked by the acidic condition of the water. To prevent an accumulation of floating cinder sludge make-up water is jetted onto the surface continuously between splash plates and is taken off at the center over a weir extending the entire width of the

hopper. The cinder which settles to the bottom of the hopper is sluiced out when desired by high-pressure jets in the hopper bottom.

Corrosion of the cinder catcher elements, forming the inlet and outlet passages, is minimized by using enameled "Armco" iron and protecting the bottom section of the gas inlet and all the gas outlet passages with an acid-resisting enamel.

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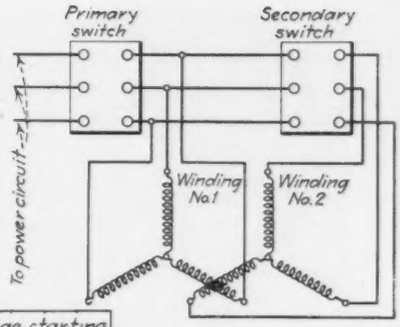
Part-Winding Starting Used in Pulp Grinder Drive

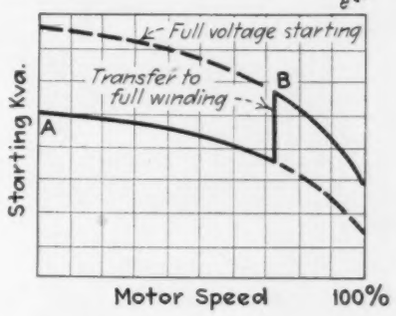
To minimize drafts of current from the line when putting pulp grinders into service at the Bucksport plant of the Maine Seaboard Paper Company the motor manufacturer provided part-winding starting. The installation consists of ten Watrous grinders with a capacity of 30 tons per day each. The grinders are driven in pairs by 3,500-hp., 6,600-volt Electric Machinery Manufacturing Company synchronous motors running at 240 revolutions per minute and designed to operate at 80 per cent leading power factor. "Mica-tite" insulation was used for protection of windings against moisture.

Two separate three-phase windings are provided for the motor stators. In starting, the push-button control closes the primary switch, thus energizing one winding at full voltage. The starting torque is from 60 to 65 per cent of full-load torque, the current inrush being about 60 per cent of the full-voltage starting current on a single-winding machine. When the speed reaches about 65 or 70 per cent of normal a relay closes the secondary switch, throwing full voltage on the second winding. At no time is the circuit opened, and the current inrush is only that associated with the application of full-load current. In case of overload the primary switch opens the circuit of both windings, which operate in parallel after the second starting switch closes.



Two-part winding scheme to cut down current inrush

In starting, one winding subjected to full voltage brings the motor up to 70 per cent speed, when the second winding is paralleled with the first at full voltage.



Limitation of current inrush as motor starts on one winding

The inrush at "B," when the second winding goes in, does not seriously exceed the initial peak.

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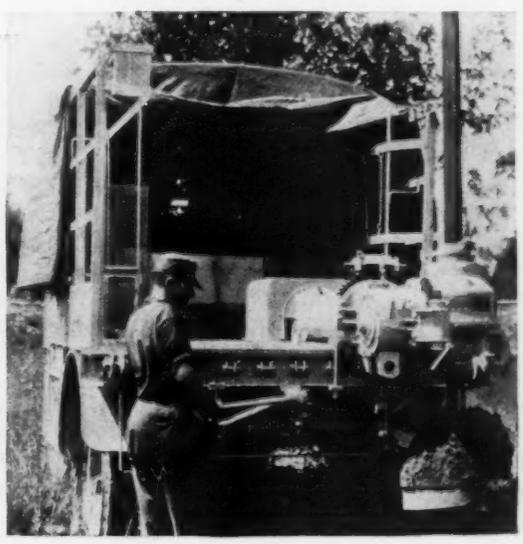
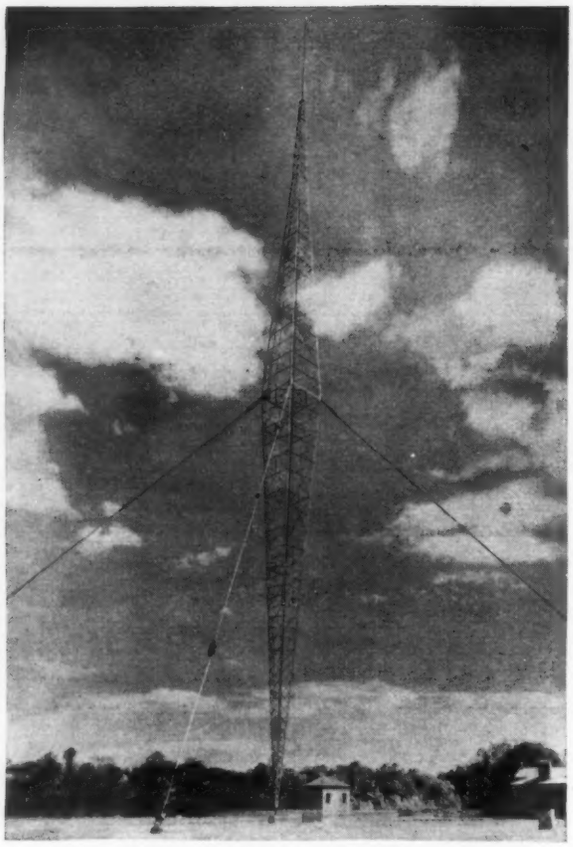
Flexible Pole Diggers

Power-driven pole diggers adapted to both truck and tractor service are widely utilized in new construction and restoration work over varying terrain. Hole-boring and pole-setting functions are combined in the latter equipment, which has been applied to caterpillar tractor service with good results. The caterpillar unit shown digs a hole 7 ft. deep and 20 in. in diameter in less than two minutes under ordinary conditions, and the auger bar can be adjusted to dig a perpendicular hole regardless of the position of the tractor, even up to a 45-deg. angle. In rough country this reduces the cost per hole over the hand method by $10 in typical cases. Some companies report that the cost of maintenance is sufficient to cut this margin somewhat, but where the conditions are favorable to mass production these machine methods make their best showing.





WABC has a new 50-kw. short-wave broadcast tower

Mast is 18 ft. square at the base and has adjustable height for tuning.

Short-Wave Broadcast Towers

By RALPH L. JENNER

Electrical Engineer
Lapp Insulator Company, Inc.

Insulators for 450,000-lb. working load.
WABC has 665-ft. vertical antenna.
Design and test details of insulators.

THE half-wave vertical antenna was suggested a number of years ago and has been used extensively for short-wave work. This construction met with such success that it aroused considerable interest among radio engineers of broadcasting companies, who at last threw out a challenge to designers to build such an antenna for radio broadcast use.

The success of this idea is dependent on the ability to insulate an immense and expensive structure of this kind with both electrical and mechanical security. With the background of many years' experience in supplying base insulators for conventional radio towers, the Lapp Insulator Company was well equipped to handle the problem. Co-operating with the Blaw-Knox Company, designer of the structure, all of the details were worked out and three separate antennas of this type have now been placed in service. The key station, WABC of the Columbia Broadcasting System, was the first to be erected.

Better to understand the general problem, let us see what difficulties are involved. We have to erect a conductor of height approximately equal to half the assigned wave length and to insulate it from ground for the full continuous operating voltage of the station. This is only in the order of 20,000 volts, but the very high frequency introduces serious complications.

The broadcast wave band extends from 1,500 kc., wave length 199.9 m., requiring a tower approximately 350 ft. in height, to 550 kc., wave length 545.1 m., requiring a tower approximately 900 ft. in height. We have to support on porcelain a tower nearly the height of the Chrysler Building.

The electrical problem is not one of flashover, as in a transmission line, but is one of dielectric loss with consequent heating, which will cause damage to the porcelain if not properly designed. Power men will readily appreciate a comparison and understand the designers' troubles. For example, radio station WABC has a frequency of 860 kc., which means the voltage passes through a complete cycle in approximately one-millionth of a second. This gives a wave-front steepness equal to, or greater than, those encountered in measured lightning discharges or, more specifically, a quarter-microsecond wave. The capacity of the insulators also has to be low to give the least possible effective capacity of the structure.

Specific design data

Consider the specific design for WABC's new 50-kw. radiator. Blaw-Knox solved the design problem with a mast structure 665 ft. high, guyed at one level only (rather unusual, but necessary to meet satisfactorily the electrical requirements), and gave us the following insulator specification.

Base Insulator—Strength 680,000 lb. and to be proof tested to this value. Capacity 50 m.m.f. To stand continuously 50,000 volts at 1,500 kc. with permissible temperature rise of 60 deg. F.

Guy Insulators—Strength 375,000 lb., capable of breaking a 2-in. plow steel cable, and to be proof tested to two-thirds of this value. Capacity of main insulator assembly 50 m.m.f. and capable of standing the same voltage as the base unit. Guy insulators for break-up use were also required to have the same strength.

From previous tests that had been made and after a consideration of a number of types of base insulator the cone type construction seemed to offer the most satis-

factory solution. By the use of the double cone, one bolted to the foundation, the other to the tower with a free rolling connection in the center, we were able to permit the tower to sway in the wind and reduce the bending moment on the insulator to a minimum. The guy insulator also uses this cone principle. The porcelain cone is cemented into a ring at the bottom and a cap at the top. The load is taken through the center eyebolt down through the cone, which is always in compression, then up through the side bolts.

How tests modified initial design

After a study of all features, designs were made and samples produced. Mechanical tests were made in our 1,000,000-lb. hydraulic testing machine. Preliminary tests showed minor weakness in certain of the steel parts, but the porcelain cones fully met the specifications. The trouble encountered was some permanent deformation in the metal parts, although no breaks occurred below the specified loads. The guy insulator broke at a load of 390,000 lb., failure occurring in the eyebolt. The base insulator carried a load of 980,000 lb. and was reloaded five times to approximately this value before the first fracture occurred. It is interesting to note that cone type insulators, even when cracked, will not disintegrate, but will sustain a pressure equal to the initial fracture load for a considerable period of time. It is this characteristic that makes them the most satisfactory type for sustaining these extreme loads.

The steel specification in the caps of both base and guy insulators was changed so as to carry the excessive intensity of loading at those points. These are of heat-treated alloy steel, the eyebolts and side bolts also being heat treated.

The next factor to be checked was the ability to meet the electrical requirements. Units similar to those subjected to mechanical test were shipped to the Bell Telephone Laboratories, where flashover and heat runs were made. Types of shields for grading and elimination of corona were studied. In these tests the heating was somewhat greater than expected and it was found necessary to increase the separation between the metal parts. The elimination of sharp points was also found very necessary to reduce the corona and raise the flashover. With the proper rounding of metal parts the flashovers are of the same order as with 60-cycle voltage. With this wealth of information at our disposal final designs were undertaken. One surprising fact that developed in the test was the shielding effect of the bolts in the guy design, the heating was comparatively moderate and the flashover more than adequate to fulfill the specifications.

In the final design the base unit has 16 in. separation between the metal parts. The flanges are held, the top one to the tower casting by four cap screws at 24-in. centers and the bottom one to the foundation by four bolts on the same centers. The caps in the center of the base insulator are held in relation with a dowel cast into the lower cap and fitting into a receiving socket in the upper one. The whole assembly is 46¾ in. in height and the minimum diameter of porcelain is 9 in. The capacity is 12 m.m.f., only 25 per cent of that specified, and the flashover is greater than any voltage available at this frequency.

Lightning protection is a strongly advisable detail in structures of this type, which virtually act as lightning rods. An adjustable gap (3 to 6 in.) with 3-in. spheres has been placed on the base unit. The guy units are self-protecting, due to the proximity of the surrounding metal parts.

The guy units, 28 in all, are of the clevis and eye type and are attached to the regular open and closed sockets suitable for 2-in. cable. The main insulator consists of four in series, attached directly to the tower. To prevent reradiation from the guys they are broken into four sections by three more identical units.

The development and testing of these units has increased our knowledge to such an extent that much larger designs have been made and at this writing we are completing the details for a European installation that will have a tower 1,045 ft. in height. The base insulators will be required to stand a test of 1,800,000 lb. and the guy units to break a 2¼-in. plow steel cable having a strength of 470,000 lb.

Details of Broadcast Tower Insulators

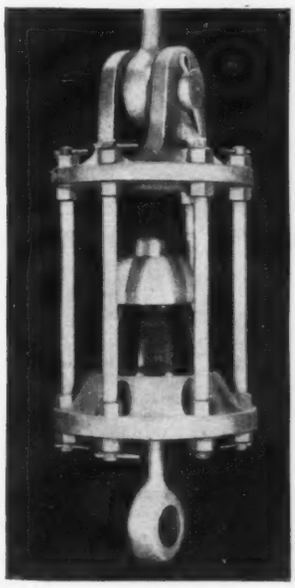
	Base Insulators	Guy Insulators
Length	46¾	37½
Weight, lb.	921	465
Ultimate strength, lb.	1,000,000	400,000
Required strength, lb.	680,000	375,000
Minimum diameter of porcelain, in.	9	7
Flash distance, in.	32	6

Factory Specifications for Broadcast Insulators

Base Insulators	Guy Insulators
Proof Test — 250,000-lb. load held for five minutes. Increase in steps of 50,000 lb. each and hold for five minutes. Continue to 450,000 lb., 680,000 lb. to be held for one minute.	*Proof Test* — 50,000-lb. load held for five minutes. Increase in steps of 50,000 lb. each and hold for five minutes. Continue to 250,000 lb.
Design Test — One unit to be tested to destruction.	*Design Test* — One unit to be tested to destruction.
The factory reports Proof test O.K. Initial break 980,000 lb. Failure 1,100,000 lb.	*The factory reports* Proof test O.K. Bolt broke at 395,000 lb. Porcelain cracked on the rebound.

This insulator of porcelain supports the 62½-ton broadcast tower

Guy insulators used were tested to 375,000 lb.



German Experience wi

By Dr. A. MENGE
President Bayernwerk A.G., Munich

Some American engineers returning from Europe have expressed the opinion that we have not given sufficient consideration to the value of Petersen coil arcing-ground suppressors. Consequently Dr. A. Menge, president Bayernwerk A. G., Munich, has been asked to relate his company's experiences with this device and to answer some of the criticisms which have been raised to this form of protection.

His company is declared to be the first large 100-kv. system in Germany to be completely equipped with Petersen coils from the commencement of service. Fourteen such coils, rated at about 1,000 amp., and totaling about 64,000 kva. capacity, are used on this system, composed of about 2,000 km. of overhead lines and underground cable.

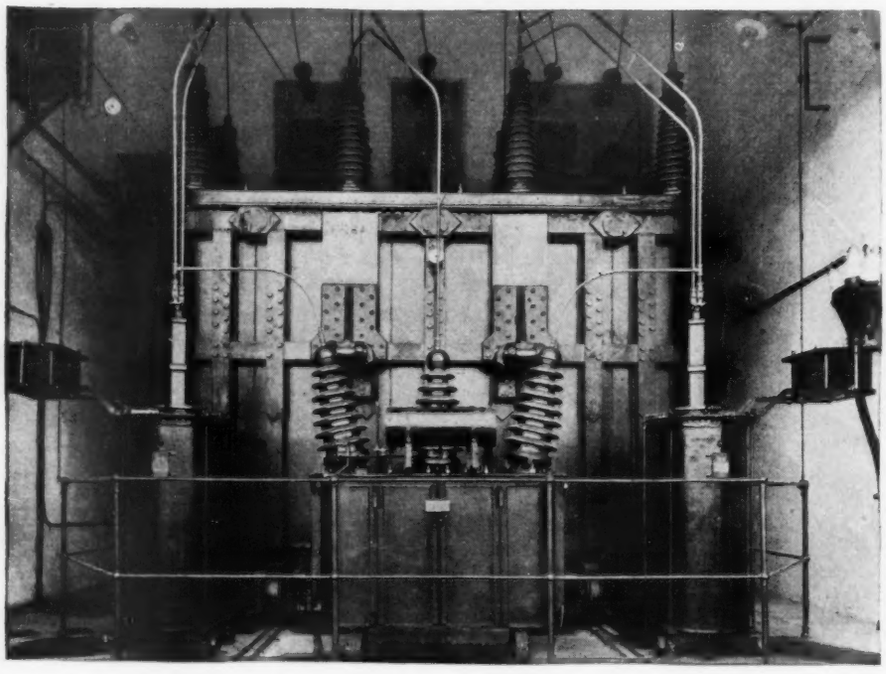
Today all overhead lines in Germany, rated at 100 kv. and upward, are said to be operated with this system of protection.

DIFFERENT methods have been adopted in the United States and Germany for dealing with the grounding of the neutral of high- and supertension systems. The reason why a question arose at all as to whether, and how, the neutral point should be grounded is due to the relatively high percentage of single-phase faults that occur.

If the neutral of a network is insulated, every single-phase breakdown results in a fault to ground and a displacement of the total system potential to ground. The arcing phenomena resulting at the faulty point cause the disastrous overvoltages of reignition. Moreover, particularly in extensive networks, the current to ground not only creates potential differences along the ground near the fault dangerous to man and animals, but simultaneously disturbs neighboring telephone lines by inductive effects. Rapid disconnection of the faulty section is therefore imperative. Although numerous suggestions are made, I am not aware of any protective device that may be considered as fully reliable for disconnecting faults to ground in networks with an isolated neutral as the arcing ground suppressors subsequently discussed.

Apparently the foregoing difficulties formed the main reason for the preference given to the grounded neutral throughout the United States. With this system the clearing of a line from a fault to ground is limited to the problem of a normal short circuit. Therefore no special ground protection devices are necessary. All that has to be done is to modify the customary approved short-circuit protective devices in such a way that they will operate on single-phase "shorts." Among others, this method involved the disadvantage that the current flowing through the ground is considerably increased and intensifies the detrimental effects associated therewith.

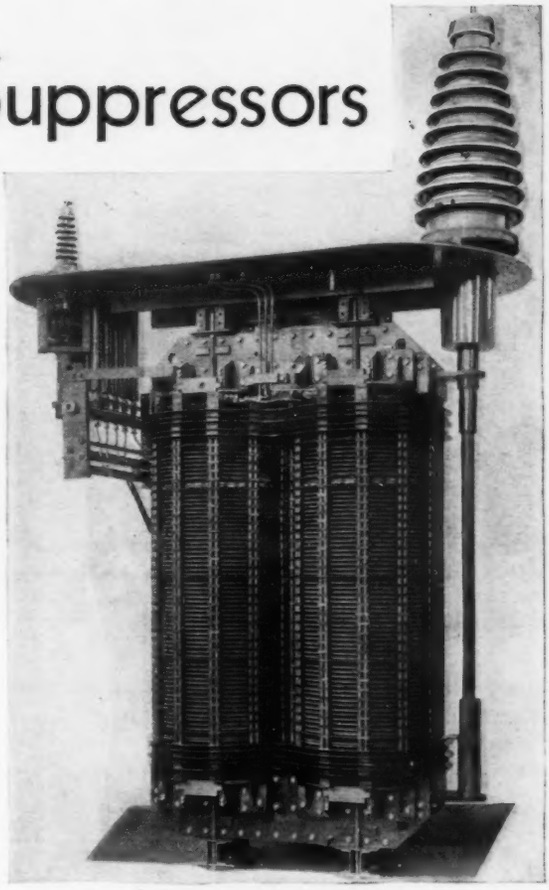
In 1917 Professor Petersen proposed the use of the arcing ground suppressor for dealing with the faults to ground.



Isolating transformer between systems requiring independent ground protection

The transformer is rated at 35,000 kva and is equipped to regulate voltage between systems.

e with Arcing-Ground Suppressors



3,200-kva. Petersen coil with taps for various currents

Taps are provided for 50, 42, 35, 29 and 25 amp.

Without going into details the function of the Petersen coil may be briefly reiterated: Inductive resistances are inserted between the network neutral and ground, these being tuned so that the inductive current passing through them during a line-to-ground fault equals or approximately equals the capacitive current which would flow to ground at the faulty point in the absence of the inductances. The insertion of the latter has the effect that the capacitive current to ground via the line fault is limited to a perfectly harmless residual current and reignition is avoided. Immediate disconnection of the faulty section becomes no longer important. In fact, a line can be maintained in service with a fault to ground for two hours and more, depending on the rating of the suppressors. It is sufficient to have an indication of the line on which the fault has occurred and disconnect it after the continuity of the supply to the consumers had been assured by switch-over arrangements.

Nearly all high-tension systems* in Germany have, one after the other, adopted this system of arcing ground suppression, although for some time it was strongly opposed by companies once favoring the solidly grounded neutral. In the following will be related some of the operating experiences with Petersen coils on a large 100,000-volt network in Germany, viz., the Bayernwerk system. This network was put into service during 1923 and 1924. It was equipped with Petersen coils from the outset. Complete records concerning all faults to ground and short circuits that have occurred are available from the year 1925 onward. Table I, compiled on the basis of these statistics, shows the number of the pure single-phase faults to ground as well as the two- and three-phase short circuits resulting in disconnection of the line.

During the six years recorded, a total of 354 grounds and short circuits occurred in the Bavarian system. Of these, however, only the short circuits (25 per cent) caused the oil breakers to trip. The remaining 75 per cent faults had no effect on the consumers. If the system had been operated with solidly grounded neutral, all of the 354 disturbances would have been of a short-circuit character and therefore necessitated immediate switching out of the line. The voltage drop and the fluctuations of the frequency caused thereby would have involved a number of undesirable consequences for the consumers, it is believed.

A considerable percentage of the grounds were suppressed immediately and did not require any switching, this being particularly the case during thunderstorms, when insulators flash over. The faults to ground did not jeopardize operation. All we had to do was to locate the faults when convenient, and if necessary replace the defective insulators.

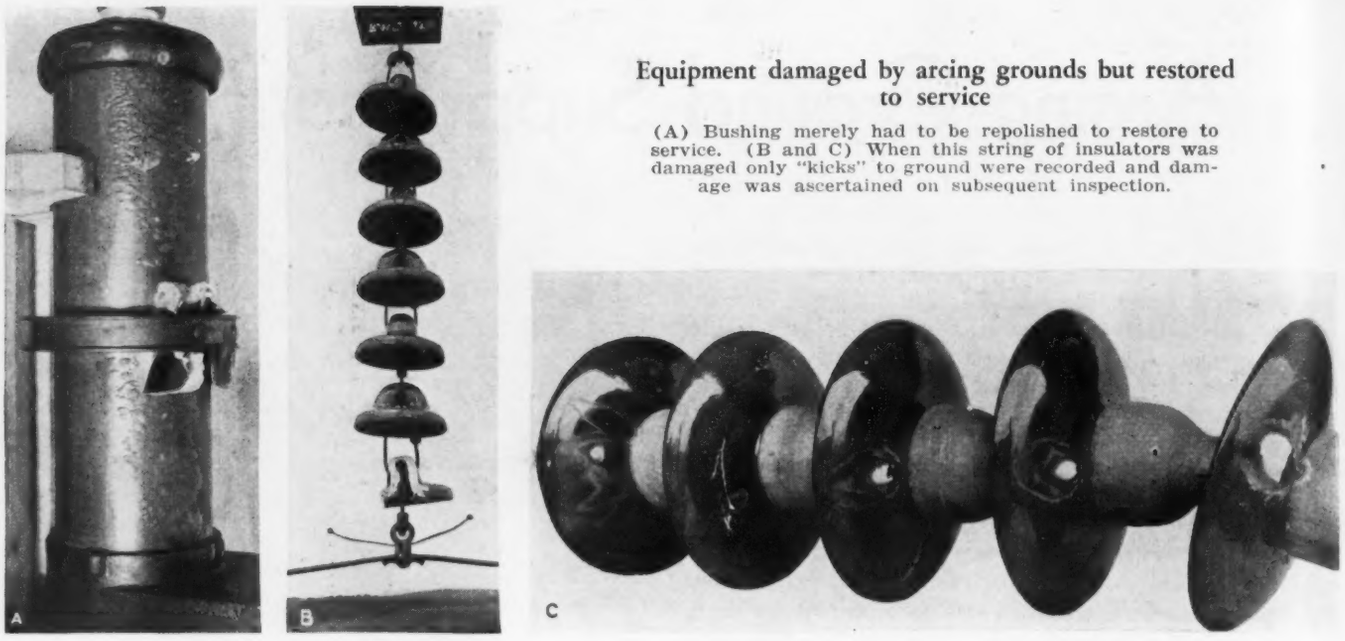
Furthermore, Table I proves that less than 25 per cent of the faults to ground develop into a fault between phases, or short circuit, since a considerable portion of the faults, characterized as short circuits, was certainly not initiated by grounds. On the other hand, it was evident when the Bavarian network was directly interconnected with a non-compensated network, which prevented tuning of the Petersen coils, that every fault to ground resulted in a short circuit.

Even when operating with a fault to ground for a long period the damage inflicted on the faulty point of the line was always minute. The harmlessness of such a fault is easily explained, because the Petersen coil limits the current flowing over the faulty point of the line to ground to a negligible value. In many such circumstances it was difficult to detect the faulty string of insulators during

**Include Elektrowerke A.G., Rheinisch-Westfälisches Elektrizitätswerk A.G., and Preussiche Elektrizitäts A.G.*

Table I—Faults to Ground and Short Circuits on Bayernwerk Network

Year	Single Length of Line (Km.)	Single-Phase Flashovers Not Causing Line to Trip (Faults to Ground) Total No.	Faults per Km. of Line per Annum	Disturbances Causing Tripping of Line (Short Circuits) Total No.	Number of Disturbances per Km. of Line per Annum
1925	1,200	26	0.022	16	0101333
1926	1,350	22	0.0163	12	0.00888
1927	1,600	29	0.0181	15	0.0094
1928	1,941	80	0.0412	13	0.0067
1929	2,000	58	0.029	15	0.0075
1930	2,036	48	0.024	20	0.0098
Total		263		91	
Per cent		74.3		25.7	



Equipment damaged by arcing grounds but restored to service

(A) Bushing merely had to be repolished to restore to service. (B and C) When this string of insulators was damaged only "kicks" to ground were recorded and damage was ascertained on subsequent inspection.

the subsequent inspection of the line. Despite prolonged operation with a fault to ground, the insulators did not show signs of damage that could be seen from the ground.

The lines have been repeatedly operated with a fault to ground for up to two hours. Immediate disconnection and the consequent interruption of the supply to the consumer was invariably averted, and it was possible to maintain the supply over the disturbed section until the delivery of energy was insured by switching operations or heating up standby boilers.

Endangerment of life or adverse effects upon telephone systems in the vicinity of the fault have not been known, despite the density of the population in the districts traversed by the lines. In fact, it has repeatedly been proved that people who have worked in the immediate vicinity of the fault were in no way affected. In four instances, thanks to the immediate suppression of the arcing ground by the coils, persons who had touched the high-tension lines, either inadvertently or with suicidal intent, were preserved from grave consequences. They merely suffered more or less severe burns which healed completely, so that to-day they are again following their previous occupations.

To determine the limits of accuracy needed in tuning the Petersen coil so its function of arcing ground suppression would be preserved the Bayernwerk company carried out numerous tests with faults to ground during normal service. It was ascertained that under the conditions existing on the Bavarian network with a dissonance between the Petersen coil and the capacitive current to ground up to ± 10 per cent it was still possible to suppress the arc. During these tests the residual current flowing to ground at the fault amounted to 30-70 amp. at a total capacitive current to ground of about 750 amp.

Generally, the permissible limit of dissonance is higher the smaller the network and the higher the critical voltage for the corona losses. Since proper tuning naturally improves the conditions, especially in large networks, such as the Bavarian, we operate as a rule in such a way as to maintain the best possible degree of compensation.

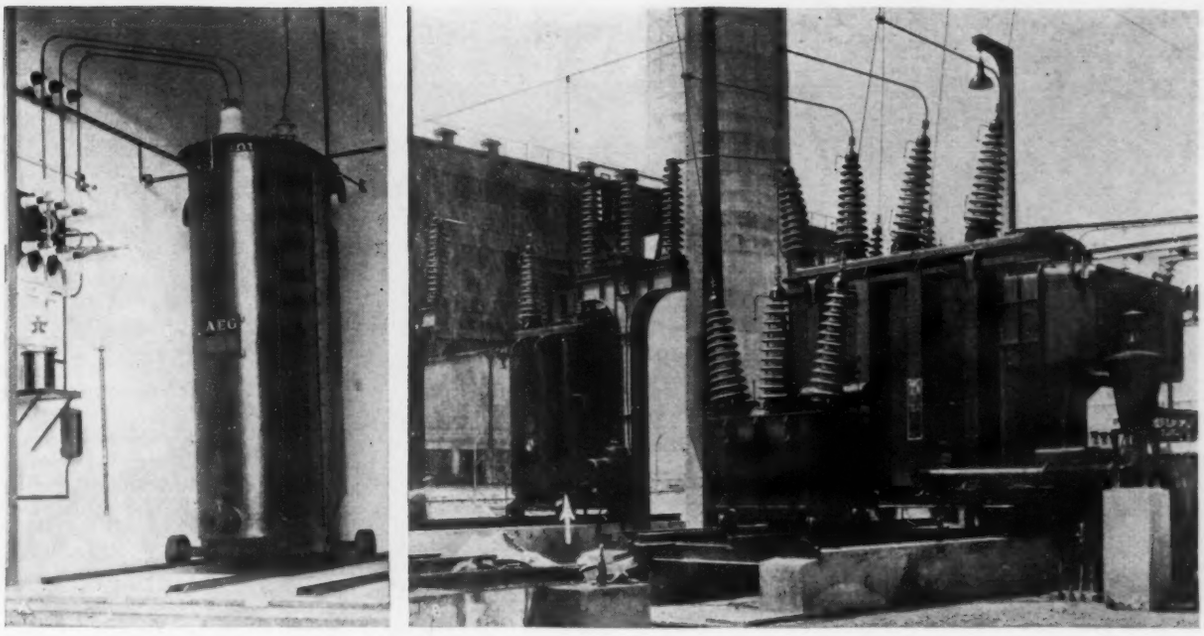
In order to realize satisfactory compensation of the network at all times, instruments have been installed which indicate the potential at the neutral point to ground and thus provide a continuous measurement of the degree of compensation. In such a way it was also ascertained that the capacitance to ground of overhead systems varies during the year and to a certain extent depending upon the growth of crops, the alteration of the foliage of forests and the variation of the sag at different temperatures.

The question has been raised repeatedly whether the unbalanced residual current with large networks would increase to such an extent as to prevent the suppression of the arcing ground. The Bayernwerk company has not experienced any difficulties in this respect. Nevertheless, we recommend electrical isolation, as regards current to ground, between large systems, if several concerns like the Bayernwerk are going to be interconnected, in order to preserve independence in balancing each of these sytems individually. To this end the systems have to be interconnected by isolating transformers with a 1:1 ratio if both systems work at the same voltage. These isolating transformers may also be used for regulating the pressure between the systems, which is needed in almost every case for such interconnections. It is obvious that isolating transformers provide, quite generally, a remedy in limiting the residual currents, if it should be found that a system is getting too large.

Based on the operating experiences of the Bayernwerk, company it is now proposed to deal with some of the

Table II—Neutral Point Flashovers on Bayernwerk Network Since Beginning of Service

Transformer Stations	Terminal Station	Intermediate Station	Number of Flashovers
Karlsfeld	...	Yes	5
Kochel	Yes	...	8
Landshut	...	Yes	3
Aschaffenburg	Yes	...	2
Arzberg	Yes	...	2
Totals:	3	2	20
Number of transformer stations equipped with Petersen coils	5	5 total:	10



Indoor and outdoor installations of Petersen coils

(A) This indoor unit is rated at 2,700 kva., 60/100 kv. and has 40-, 45- and 35-amp. taps. (B) The outdoor unit mounted at the left of transformer is rated at 4,800 kva., 60/110-kv., and has a remote-control change-over switch for 80-, 75-, 70- and 65-amp. taps

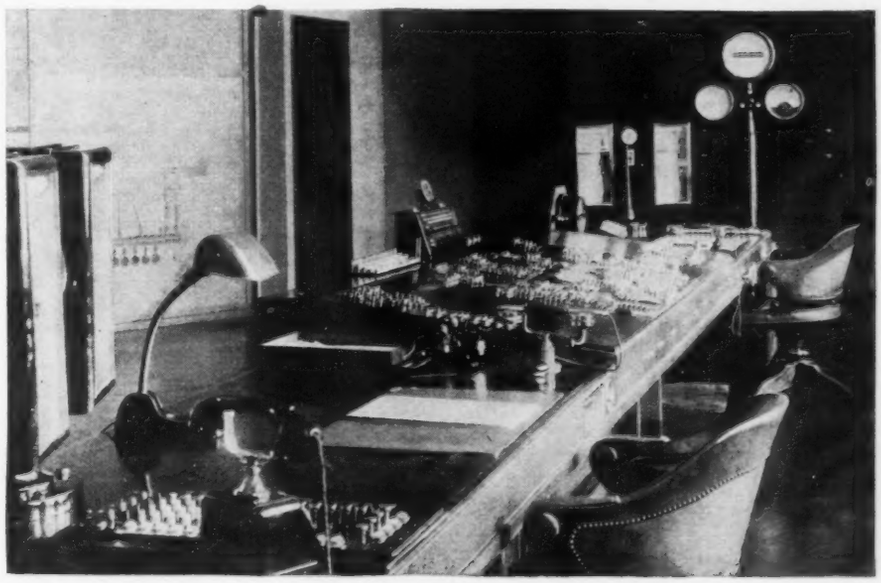
objections that have been raised against the employment of arcing-ground suppressors in the past.

Under certain load conditions, it has been asserted that the Petersen coils, owing to a kind of resonance, displace the potential of the neutral point and thereby interfere with operation. Nothing of this kind has yet been observed in the Bavarian system†. It has happened with lines of insufficient symmetry that the potential at the neutral point rose up to 22 per cent of the phase voltage, but by properly transposing the lines this voltage could be reduced to about 1 per cent. In fact, the potential of the neutral provides a simple means of checking whether a line is properly transposed and fulfills the conditions of symmetry stipulated by the general regulations of interference with telephone service. Further such observations permitted other irregularities in service to be ascertained, such as time lag between the phases of oil circuit breakers or single-phase opening of breakers or other abnormal switching operation.

Moreover, it has been contended that the arcing ground suppressors reflect disturbances and do not prevent the discharge of overvoltages to ground, thereby becoming particularly conducive to flashover. The experiences of the Bayernwerk company in this respect are as follows: During the six service years under observation neutral point flashovers occurred in five of the ten transformer stations equipped with Petersen coils (see Table II). Of these the flashovers in the Karlsfeld transformer station should be excluded because they were due solely to a special arrangement of connections—a potential transformer was connected in parallel with the Petersen coil to the neutral bus. Apparently the Petersen coil potential transformer and neutral bus formed a resonant circuit. After inserting a damping resistance in the potential transformer circuit, as is customary to limit the current in the case of a "short," no further flashovers at the neutral occurred.

Three of the other transformer stations affected by flashover are terminal stations. With these, all neutral-point flashovers happened during lightning storms accompanied by flashover in the switching plant and sometimes on the lines. It seems reasonable to assume in these

†*See A. E. G. Mitteilungen, 1931. H 6 "Resonanz-Uberspannungen am Petersen-System."*



Bayernwerk load dispatcher has instruments for continually checking compensation of Petersen coils

Asymmetric Reflectors Avoid Glare at Filling Station

Uniform illumination at a filling station in Hartford, Conn., is realized by an installation of ten Holophane asymmetric type reflectors spaced 40 ft. apart and mounting 300-watt clear-bulb tungsten lamps 18 ft. above ground. The absence of glare is apparent in the reproduced night photograph, in which the camera was aimed directly toward the ten principal lighting units. The installation was designed by the illuminating engineering department of the Hartford Electric Light Company.

▼ ▼ ▼

cases that flashover would have occurred just the same with a solidly grounded neutral and that they could only be avoided by lightning arresters located so no overvoltages could enter the station. Regarding the three flashovers at the neutral in Landshut, no satisfactory explanation has been found. They may have been affected by the construction of the transformers, since they are of different make from those in other stations having similar conditions where no flashovers were observed.

Objections have been raised to arcing-ground suppression devices in the belief that they will markedly increase the cost of the entire plant as the phase conductors must be insulated for the line voltage. Today this objection seems no longer justified, as the general practice nowadays is not to insulate lines merely for stresses imposed by normal operation but to withstand all conditions, especially traveling waves. Even if only waves of moderate height and steepness are taken into account, their potentials are no doubt much higher than the line voltage between conductors. Therefore, so far as cost of line insulation is concerned, it does not make any difference whether the neutral is grounded or not.

These facts and equally favorable results obtained by other German companies using Petersen coils seem to prove that the course taken in Germany to deal with faults to ground has been successful.

▼

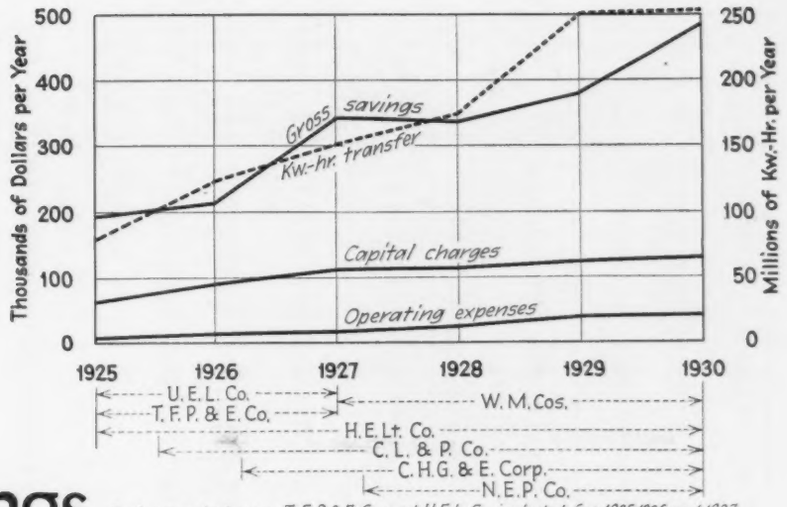
Galvanized Structures Favored for Outdoor Substations

Galvanizing of outdoor substation structures seems to be preferable to painting, according to reports* obtained from seven large companies by the N.E.L.A. electrical apparatus committee. Life of galvanizing is reported to range from permanency to a minimum of four or five years, according to the reports, and costs from 15 to 45 per cent of the steel. Life of paint was given as two to ten years and the cost of the original painting varied from 5 to 25 per cent of the cost of the steel.

**Embodied in N.E.L.A. serial report No. 164.*

Galvanized vs. Painted Structures

Company	Galvanizing Practice				Painting Practice					Better Appearance
	Structures	Reason	Life, Years	Cost, Per Cent, of Steel	Structures	Reason	Life, Years	Cost, Per Cent, of Steel	Cost of Repairing, Per Cent	
Philadelphia Electric Co.	33 kv.	Research	7 to 8	25	All except 33 kv.	Better job	4	20	15	Galvanized
Detroit Edison Co.....	All—also 24-kv. O.C.B.'s	Greater life	Unknown above 8	35 to 45	None	.....	4	35 to 40	Above initial	Same
Stone & Webster Engineering Corp.....	All permanent	Economy	Over 15	15	Temporary	Economy	2–5	5	7	Galvanized
Columbia Engineering & Management Corp.	All outdoor	Longer life	4–5	30	Old galvanized	.....	3–4	25	10	Galvanized
Electric Bond & Share Co.....	All outdoor	Economy	Permanent	15–20	None	.....	Lead and oil or graphite 2 to 3—Bitumastic 5 to 10	.....	.....	New
Southern California Edison Co.....	All	Economy	Varies	26	None	.....	3–5	12.5	6.7	Galvanized
Consumers Power Co...	All	Economy	5 to over 30	15 to 20	None	.....	3	.....	.....	Galvanized



Exchange between T. F. P. & E. Co. and U. E. L. Co. included for 1925, 1926 and 1927

Calculating Savings from Power Interchange

By E. C. BROWN

Assistant Manager Connecticut Valley Power Exchange

FOR six years the members of the Connecticut Valley Power Exchange have been pooling their generating and transmission facilities and operating their combined systems as a single unit for the best over-all economy. The savings from this combined operation as well as from exchanging power with non-member interconnecting companies are distributed among the members and in 1931 amounted to more than $500,000. Since the scheme is meeting with increasing favor it is possible that other companies which do not have a common financial ownership to aid them in operating a power pool may find value in the method used for calculating the savings and distributing them among the members.

The exchange was organized in 1925 when three companies in this territory found that, by the expenditure of less than one million dollars in a transmission line, the construction of plant additions costing several times this amount would be postponed for several years and that substantial operating savings could be realized in the more efficient use of existing facilities under joint operation. At the outset it was recognized that effectively to pool facilities for optimum advantage it would be necessary to have a free exchange of power determined only by the operation of the combined systems for the maximum economy, unhampered by complicated contracts or arbitrary rules of procedure. Out of this realization came the formulation of the following principles:

1. Each member company shall have sufficient capacity to carry its yearly peak plus a reserve of 10 per cent. This capacity may either be installed in the plants of the company or furnished under contract by some other company.

2. Each member company supplying energy to the exchange will be reimbursed by the increment cost it incurs in supplying such energy.

3. Each member company receiving energy from the exchange shall be charged the increment cost it would incur in generating such power.

4. The capital charges on additional facilities made necessary by joint operation shall be the first charge against savings which such facilities create.

5. The net savings remaining after the deduction of the capital charges and operating cost of the exchange shall be equitably divided among the member companies. In consideration of the equities of the several companies, the market and the source shall be of equal importance. That is to say, the company which furnishes a market for a block of economy power and the company which generates this power are both equally essential to the completion of the transaction and should, therefore, share equally in the savings.

6. The zeal for the creation of savings shall never encroach upon the standards of service and safety of operation which the individual component companies find it necessary to adopt.

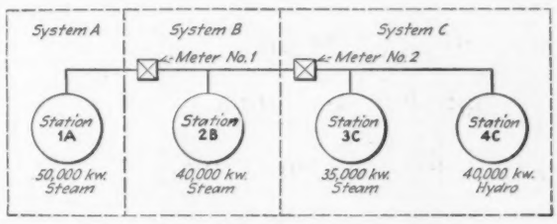


Fig. 1—Hypothetical system used to explain calculations

At the present time the Connecticut Valley Power Exchange is composed of three companies: The Connecticut Light & Power Company, the Hartford Electric Light Company and the Western Massachusetts Com-

	Sta. 1 A			Sta.2B	Sta. 3 C			Sta.4C	System	Meter #1		Meter #2		Calculated		Co.A	Co.B	Co.C
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Hr.	Gross Output	Units on Line	Boilers Fired	Gross Output	Gross Output	Units on Line	Boilers Fired	Gross Output	Gross Hourly Output	Co. "A" to Exch.	Co. "A" from Exch.	Co. "C" to Exch.	Co. "C" from Exch.	Co. "B". to Exch.	Co. "B" from Exch.	System Load	System Load	System Load
1	15	1	5	35	--	-	5	--	50		1		20	21		16	14	20
2	10	1		35	--	-		--	45		4		18	22		14	13	18
3	10	1		30	--	-		--	40		5		16	19		13	11	16
4	10	1		30	--	-		--	40		5		16	19		13	11	16
5	10	1		30	--	-		--	40		5		16	19		13	11	16
6	15	1		35	--	-		--	50		1		20	21		16	14	20
7	25	2		35	--	-		--	60	6			24	18		19	17	24
8	45	2		40	5	1		--	90	16			31	15		29	25	36
9	45	2		40	5	1		10	100	13			25	12		32	28	40
10	45	2		40	5	1		15	105	11			22	11		34	29	42
11	45	2		40	5	1		15	105	11			22	11		34	29	42
12	45	2		40	5	1		10	100	13			25	12		32	28	40
1	30	2		35	5	1		--	70	8			23	15		22	20	28
2	45	2		40	5	1		10	100	13			25	12		32	28	40
3	45	2		40	5	1		10	100	13			25	12		32	28	40
4	45	2		40	5	1		10	100	13			25	12		32	28	40
5	45	2		40	5	1		10	100	13			25	12		32	28	40
6	45	2		40	5	1		35	125	5			10	5		40	35	50
7	45	2		40	5	1		20	110	10			19	9		35	31	44
8	45	2		40	5	1		15	105	11			22	11		34	29	42
9	45	2		40	5	1		5	95	15			28	13		30	27	38
10	45	2		40	--	-		--	85	18			34	16		27	24	34
11	35	2		40	--	-		--	75	11			30	19		24	21	30
12	25	1	5	40	--	-	5	--	65	4			26	22		21	18	26
Total	815			905	70			165	1955	204	15		547	358	--	626	547	782

Note: All load figures are in thousands of K.W.H.

Table I— Data from Log Sheet—the Starting point for Calculations

These data are for a typical low-water day. The power transfers between the pool and companies A and C are given by meters No. 1 and No. 2 (columns 10 to 13 inclusive). The transfer between the pool and company B is the algebraic sum of meters 1 and 2 (see column 14) because the total incoming power to the pool must equal the total outgoing.

Table II— Coal Calculations for Station 1A (Low-Water Day)

Columns 1 to 5 inclusive are taken directly from the operating records (Table I, columns 1, 2, 3, 10 and 11). The algebraic sum of columns 1, 4 and 5 gives column 6, which is the load station 1A would have generated if it had not been interconnected. Columns 7 and 8 show respectively the generators and boilers needed for independent operation neglecting operating reserve. Columns 9 to 12 inclusive show the coal requirements in thousands of pounds as secured from Table IV for the conditions indicated in column headings.

	1	2	3	4	5	6	7	8	9	10	11	12
Hr.	Sta.1A Actual Output	Actual Units on Line	Actual Boilers Fired	Co."A" to Exch.	Co."A" from Exch.	Sta. 1A Own Load = System Load - Co A Load	Units for Load in Col. #6	Boilers Fired for Load in Col. #6	Coal required for load in Col. #1 when power is To Exch.	Coal required for load in Col. #1 when power is From Exch.	Coal required for load in Col. #6 when power is To Exch.	Coal required for load in Col. #6 when power is From Exch.
1	15	1	5		1	16	1	4		16.8		17.8
2	10	1			4	14	1			12.1		15.8
3	10	1			3	13	1			12.1		14.9
4	10	1			3	13	1			12.1		14.9
5	10	1			3	13	1			12.1		14.9
6	15	1			1	16	1			16.8		17.8
7	25	2		6		19	1		28.3		20.8	
8	45	2		16		29	2		50.5		32.2	
9	45	2		13		32	2		50.5		35.5	
10	45	2		11		34	2		50.5		37.8	
11	45	2		11		34	2		50.5		37.8	
12	45	2		13		32	2		50.5		35.5	
1	30	2		8		22	2		33.3		25.4	
2	45	2		13		32	2		50.5		35.5	
3	45	2		13		32	2		50.5		35.5	
4	45	2		13		32	2		50.5		35.5	
5	45	2		13		32	2		50.5		35.5	
6	45	2		5		40	2		50.5		44.5	
7	45	2		10		35	2		50.5		38.9	
8	45	2		11		34	2		50.5		37.8	
9	45	2		15		30	2		50.5		33.3	
10	45	2		18		27	2		50.5		30.2	
11	35	2		11		24	1		38.9		26.3	
12	25	1	5	4		21	1	4	27.4		23.0	
Total	815		Blr.Hrs. 120	204	15	626		Blr.Hrs. 96	824.9	82.0	601.0	96.1

Table III— Calculations for Station 2B (Low-Water Day)

Coal requirements are calculated from a coal bogey similar in form to Table IV.

	1	2	3	4	5	6	7	8
Hr.	Sta.2B Actual Output	Co. "B" to Exchange	Co. "B" from Exchange	Sta. 2B Own Load - Co. "B" System Load	Coal required for load in Col.#1 when power is To Exchange	Coal required for load in Col.#1 when power is From Exchange	Coal required for load in Col. #4 when power is To Exchange	Coal required for load in Col. #4 when power is From Exchange
1	35	21		14	32.1		14.2	
2	35	22		13	32.1		13.5	
3	30	19		11	27.5		11.9	
4	30	19		11	27.5		11.9	
5	30	19		11	27.5		11.9	
6	35	21		14	32.1		14.2	
7	35	18		17	32.1		16.6	
8	40	15		25	37.5		23.0	
9	40	12		28	37.5		25.7	
10	40	11		29	37.5		26.6	
11	40	11		29	37.5		26.6	
12	40	12		28	37.5		25.7	
1	35	15		20	32.1		19.0	
2	40	12		28	37.5		25.7	
3	40	12		28	37.5		25.7	
4	40	12		28	37.5		25.7	
5	40	12		28	37.5		25.7	
6	40	5		35	37.5		32.1	
7	40	9		31	37.5		28.4	
8	40	11		29	37.5		26.6	
9	40	13		27	37.5		24.8	
10	40	16		24	37.5		22.3	
11	40	19		21	37.5		19.7	
12	40	22		18	37.5		17.4	
Total	905	358	--	547	843.0	--	514.9	--

Fig. 2—Input-output curve for station 3C

Company C during low-water day received 547,000 kw.-hr. (Table I) from the exchange, but would have had to generate this amount in station 3C under independent operation, because hydro station 4C generated all it could from its day's river flow. As station 3C is on a system with a hydro station of moderate size, coal calculations based on an average input-output curve (Fig. 2) are well within the limits of accuracy. Note that the actual coal burned is used for the basis of calculations for exchange operation because the curve is plotted for independent operation, and the company is charged or credited for variations from the coal consumption of independent operation caused by exchange operation.

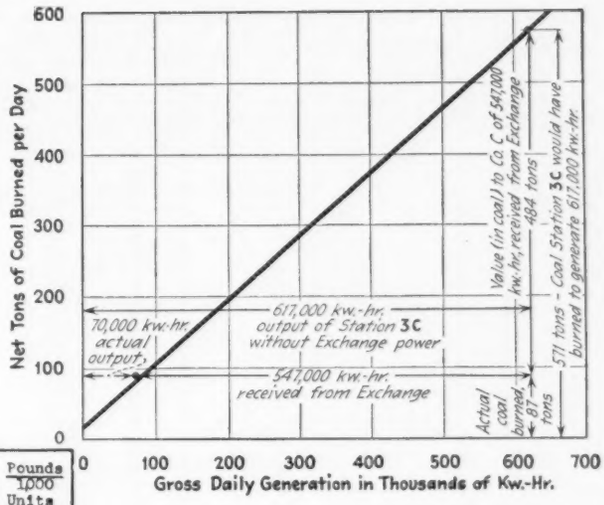


Table IV—Coal Bogey for Station 1A

50-70 deg. injection water.

Gross Load K.W.H. ÷ 1000	Blrs.	Pounds Coal - 1000 One Unit	Pounds Coal - 1000 Two Units	Gross Load K.W.H. ÷ 1000	Blrs.	Pounds Coal - 1000 Two Units
5	1	7.8		31	4	34.4
6	1	8.6		32	4	35.5
7	1	9.4		33	4	36.6
8	1	10.4		34	4	37.8
9	1	11.2		35	4	38.9
10	1	12.1	14.9	36	4	40.0
11	2	13.0	15.7	37	4	41.1
12	2	13.9	16.6	38	4	42.2
13	2	14.9	17.4	39	4	43.4
14	2	15.8	18.2	40	4	44.5
15	2	16.8	19.1	41	5	45.7
16	2	17.8	20.0	42	5	46.9
17	2	18.8	20.9	43	5	48.0
18	2	19.8	21.8	44	5	49.2
19	2	20.8	22.7	45	5	50.5
20	2	21.9	23.6	46	5	51.7
21	3	23.0	24.5	47	5	53.0
22	3	24.1	25.4	48	5	54.2
23	3	25.1	26.3	49	5	55.4
24	3	26.3	27.3	50	5	56.7
25	3	27.4	28.3			
26	3		29.3			
27	3		30.2			
28	3		31.3			
29	3		32.2			
30	3		33.3			

Note: The coal in this table is generating coal only. To get total add 250 pounds per hour per boiler fired.

panies. Interconnections with the Central Hudson Gas & Electric Corporation and the New England Power Company are operated for the exchange of large blocks of economy power to mutual advantage. The combination of the loads and facilities of the three member companies results in a system having an annual output of 1,200,000,000 kw.-hr. and a peak of 300,000 kw.-hr. per hour.

In the operation of the exchange no cognizance is taken of the three separate but component entities of which it is composed. All the facilities are available and operated to maximum advantage with respect to the combined system. Under this plan, savings must of necessity result from every operation. After the facilities of the three companies have been operated as though they were but one large company, the charges and credits between the companies must be calculated.

To simplify the explanation of these calculations a complete problem has been formulated, based on the hypothetical system shown in Fig. 1. The starting point in the computation of saving is the log sheet for the day to be calculated. Tables I and VI show the essential data for low-water and high-water conditions respectively.

Based on these data and the coal bogies for each steam plant it is possible to calculate the cost of coal that each company incurs to supply power to the exchange and the value of coal saved by each in taking power from the exchange. The calculations are shown with the log sheet data and coal bogies from which these are derived for a low-water day and high-water day. Tables V and VI show results for low- and high-water days.

With this information, the charges and credits to each company are assembled as shown in the sample exchange statement (Table X). Of course the usual billing period is one month, but results for only two days are shown

Table V—Calculations of Credits and Debits for Low-Water Day

Company A—Station 1A (low-water day)
When power is delivered to exchange

	Kw.-Hr.		Lb.	
Actual generation	745,000	Corresponding coal	834,900	(Table II, Col. 9)
Own system load...	541,000	Corresponding coal	601,000	(Col. 11)
Power to exchange	204,000	Corresponding coal	233,900	
Boiler-hours actually fired	120	(Col. 2)		
For own system load.....	96	(Col. 8)		
For exchange.....	24 at 250 lb. per boiler-hour		6,000	
Total coal burned to furnish exchange (204,000 kw.-hr.)			239,900	
Cost of coal burned to furnish exchange at $5.82 per ton			$698.11	
Average cost of coal per kw.-hr. (mills)			3.42	

When power is from exchange

	Kw.-Hr.		Lb.	
Own system load..	85,000	Corresponding coal	96,100	(Table II, Col. 12)
Actual generation	70,000	Corresponding coal	82,000	(Col. 10)
Power from exch'ge	15,000	Equivalent coal....	14,100	
Saving in coal at $5.82 per ton by using exchange power			$41.03	
Average cost of coal per kw.-hr. (mills)			2.74	

Company B—Station 2B (low-water day)
When power is delivered to exchange

	Kw.-Hr.		Lb.	
Actual generation..	905,000	Corresponding coal	843,000	(Table III, Col. 5)
Own system load..	547,000	Corresponding coal	514,900	(Col. 7)
Power to exchange	358,000	Corresponding coal	328,100	
Cost of coal burned to supply exchange (358,000 kw.-hr.) at $5.61 per ton			$920.32	
Average coal cost per kw.-hr (mills)			2.29	

Company C—Station 3C (low-water day)
When power is from exchange

	Kw.-Hr.		Tons	
Own system load*	617,000	Corresponding coal	571	(Fig. 2)
Actual output.....	70,000	Corresponding coal	87	(Fig. 2)
Power from exch'ge	547,000	Equivalent coal...	484	
Saving in coal at $5.70 per ton by using exchange power			$2,758.80	
Average coal cost per kw.-hr. (mills)			5.04	

*Actual station output plus power received from exchange.

	Sta. 1 A			Sta.2B	Sta. 3 C			Sta.4C	System	Meter #1		Meter #2		Calculated		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hr.	Gross Output	Units on Line	Boilers Fired	Gross Output	Gross Output	Units on Line	Boilers Fired	Gross Output	Gross Hourly Load	Co. A to Exch.	Co. A from Exch.	Co. C to Exch.	Co. C from Exch.	Co. B. to Exch.	Co. B from Exch.	Hr.
1	--	-	4	10	--	-	5	40	50		16	20			4	1
2	--	-	|	5	--	-	|	40	45		14	22			8	2
3	--	-	|	5	--	-	|	35	40		13	19			6	3
4	--	-	|	5	--	-	|	35	40		13	19			6	4
5	--	-	|	5	--	-	|	35	40		13	19			6	5
6	--	-	|	10	--	-	|	40	50		16	20			4	6
7	--	-	|	20	--	-	|	40	60		19	16		3		7
8	10	1	|	35	5	1	|	40	90		19	9		10		8
9	15	1	|	40	5	1	|	40	100		17	5		12		9
10	20	1	|	40	5	1	|	40	105		14	3		11		10
11	20	1	|	40	5	1	|	40	105		14	3		11		11
12	15	1	|	40	5	1	|	40	100		17	5		12		12
1	5	1	|	20	5	1	|	40	70		17	17		-		1
2	15	1	|	40	5	1	|	40	100		17	5		12		2
3	15	1	|	40	5	1	|	40	100		17	5		12		3
4	15	1	|	40	5	1	|	40	100		17	5		12		4
5	15	1	|	40	5	1	|	40	100		17	5		12		5
6	35	2	|	40	10	1	|	40	125		5	-		5		6
7	25	1	|	40	5	1	|	40	110		10	1		9		7
8	20	1	|	40	5	1	|	40	105		14	3		11		8
9	15	1	|	35	5	1	|	40	95		15	7		8		9
10	10	1	|	35	--	-	|	40	85		17	6		11		10
11	--	-	|	35	--	-	|	40	75		24	10		14		11
12	--	-	4	25	--	-	5	40	65		21	14		7		12
Total	250			585	75			945	1955	--	376	238	--	172	34	Total

Note: All load figures are in thousands of K.W.H. - Station 4C spilling water all day.
All system loads are the same as those used for low water day.

Table VI — Operating Data that Serves as Basis for Calculations on Representative High-Water Day

It will be observed that Co. C delivered 238,000 kw.-hr. to the exchange. Station 3C was operated at minimum load for voltage regulation and to furnish local reserves for an important load. Had Co. C been operating independently the output of station 4C would have been reduced by the 238,000 kw.-hr. delivered to exchange. As station 4C was spilling water all day this 238,000 kw.-hr. would have been lost and is therefore dump hydro of zero value to Co. C. From the sample statement shown later it will be observed that Co. C receives no direct credit for delivery of this power.

	1	2	3	4	5	6	7	8	9	10	11	12
									Coal required for load in Col. #1 when power is		Coal required for load in Col. #6 when power is	
Hr.	Sta.1A Actual Output	Actual Units on Line	Actual Boilers Fired	Co."A" to Exch.	Co."A" from Exch.	Sta. 1A Own Load - Co.A System Load	Units for Load in Col. #6	Boilers Fired for Load in Col. #6	To Exchange	From Exchange	To Exchange	From Exchange
1	--	--	4		16	16	1	4		--		17.8
2	--	--	|		14	14	1	|		--		15.8
3	--	--	|		13	13	1	|		--		14.9
4	--	--	|		13	13	1	|		--		14.9
5	--	--	|		13	13	1	|		--		14.9
6	--	--	|		16	16	1	|		--		17.8
7	--	--	|		19	19	1	|		--		20.8
8	10	1	|		19	29	2	|		12.1		32.2
9	15	1	|		17	32	2	|		16.8		35.5
10	20	1	|		14	34	2	|		21.9		37.8
11	20	1	|		14	34	2	|		21.9		37.8
12	15	1	|		17	32	2	|		16.8		35.5
1	5	1	|		17	22	2	|		7.8		25.4
2	15	1	|		17	32	2	|		16.8		35.5
3	15	1	|		17	32	2	|		16.8		35.5
4	15	1	|		17	32	2	|		16.8		35.5
5	15	1	|		17	32	2	|		16.8		35.5
6	35	2	|		5	40	2	|		38.9		44.5
7	25	1	|		10	35	2	|		27.4		38.9
8	20	1	|		14	34	2	|		21.9		37.8
9	15	1	|		15	30	2	|		16.8		33.3
10	10	1	|		17	27	2	|		12.1		30.2
11	--	-	|		24	24	1	|		--		26.3
12	--	-	4		21	21	1	4		--		23.0
			96					96				
Total	250		Blr.Hrs.	--	376	626		Blr.Hrs.		281.6	--	697.1

	1	2	3	4	5	6	7	8
					Coal required for load in Col. 1 when power is		Coal required for load in Col. 4 when power is	
Hr.	Sta.2B Actual Output	Co. "B" to Exchange	Co. "B" from Exchange	Sta. 2B Own Load - Co. "B" System Load	To Exchange	From Exchange	To Exchange	From Exchange
1	10		4	14		11.2		14.2
2	5		8	13		7.7		13.5
3	5		6	11		7.7		11.9
4	5		6	11		7.7		11.9
5	5		6	11		7.7		11.9
6	10		4	14		11.2		14.2
7	20	3		17	19.0		16.6	
8	35	10		25	32.1		23.0	
9	40	12		28	37.5		25.7	
10	40	11		29	37.5		26.6	
11	40	11		29	37.5		26.6	
12	40	12		28	37.5		25.7	
1	20	--		20	19.0		19.0	
2	40	12		28	37.5		25.7	
3	40	12		28	37.5		25.7	
4	40	12		28	37.5		25.7	
5	40	12		28	37.5		25.7	
6	40	5		35	37.5		32.1	
7	40	9		31	37.5		28.4	
8	40	11		29	37.5		26.6	
9	35	8		27	32.1		24.8	
10	35	11		24	32.1		22.3	
11	35	14		21	32.1		19.7	
12	25	7		18	23.0		17.4	
Total	685	172	34	547	601.9	53.2	437.3	77.6

Tables VII & VIII—Calculations for Stations 1A and 2B (High-Water Day)

Based on Table VI and coal bogies.

Table IX—Calculation of Credits and Debits for High-Water Day

Company A—Station 1A (high-water day)
When power is from exchange

	Kw.-Hr.		Lb.	
Own system load..	626,000	Corresponding coal	697,100	(Table VII Co. 12)
Actual generation	250,000	Corresponding coal.	281,600	(Col. 10)
Power from exch'ge	376,000	Equivalent coal....	415,500	
Saving in coal at $5.82 per ton by using exchange power			1,209.11	
Average cost of coal per kw.-hr. (mills)			3.22	

Note—There is no boiler adjustment for this day as total boiler hours actually fired are same as for station's own load

Company B—Station 2B (high-water day)
When power is to exchange

	Kw.-Hr.		Lb.	
Actual generation	645,000	Corresponding coal	601,900	(Table VIII, Col. 5)
Own system load..	473,000	Corresponding coal	437,300	(Col. 7)
Power to exchange	172,000	Corresponding coal	164,600	
Cost of coal at $5.61 per ton furnishing 172,000 kw.-hr. to exchange			$461.70	
Average coal cost per kw.-hr. (mills)			2.68	

Company B—Station 2B (high-water day)
When power is from exchange

	Kw.-Hr.		Lb.	
Own system load..	74,000	Corresponding coal	77,600	(Table VIII, Col. 8)
Actual generation..	40,000	Corresponding coal	53,200	(Col. 6)
Power from exch'ge	34,000	Equivalent coal....	24,400	
Saving in coal at $5.61 per ton by using exchange power			$68.44	
Average cost per kw.-hr. (mills)			2.01	

Table X—Sample Exchange Statement for Two-Day Billing Period

Based on conditions given in Tables I and VI and derived calculations (Tables V and IX) figured for high-water and low-water conditions are shown separately.

Income from Exchange Power Delivered to Members		
Company A		
15,000 kw.-hr.	$41.03	
376,000 kw.-hr.	1,209.11	
391,000 kw.-hr.	$1,250.14	
Company B		
34,000 kw.-hr.	$68.44	
Company C		
547,000 kw.-hr.	$2,758.80	
Total income		$4,077.38
Cost of Power Delivered to Exchange by Members		
Company A		
204,000 kw.-hr.	$698.11	
Company B		
358,000 kw.-hr.	$920.32	
172,000 kw.-hr.	461.70	
530,000 kw.-hr.	$1,382.02	
Company C		
238,000 kw.-hr.		
Total expense for power		$2,080.13
Gross savings		1,997.25
Operating and Capital Expenses		
Capital expenses advanced by Co. A	$235.00	
Operating expenses advanced by Co. B	75.06	
Operating expenses advanced by Co. C	85.10	
		$395.16
Net savings for three-party divisison		$1,602.09

so the reader may easily trace the problem through to the final bills.

The operating expenses shown in the statement are for salaries, supplies, etc. These expenses are paid, as incurred, by one of the companies and are charged to a special account by this company. The total of this account is rendered to the exchange for each billing period and the company is reimbursed as shown in the intercompany bills.

In order to explain the capital charges, let us assume that to make possible exchange operation with Company A it was necessary to construct a transmission line between Company A and Company B. Company A built and capitalized this line; therefore, in accordance with exchange principles, Company A should be reimbursed for the carrying charges on this new investment made for exchange operation.

Table XI—Details of Intercompany Bills

Based on Table X

Company A will bill Company C			$217.00
Arrived at as follows:			
For 204,000 kw.-hr. of exchange power delivered by Company A	$698.11		
Plus share of savings	534.03		
Plus reimbursement for capital expenses	235.00		
		$1,467.14	
Less 391,000 kw.-hr. of exchange power delivered to Company A		1,250.14	
			$217.00
Company B will bill Company C			
Arrived at as follows:			
For 530,000 kw.-hr. of exchange power delivered by Company B	$1,382.02		
Plus share of savings	534.03		
Plus reimbursement for operating expenses	75.06		
		1,991.11	
Less 34,000 kw.-hr. of exchange power delivered to Company B		68.44	
			$1,922.67
Check of Bills			
Sum of two bills to Company C			$2,139.67
Arrived at as follows:			
For 547,000 kw.-hr. of exchange power delivered to Company C	$2,758.80	$2,758.80	
Less share of savings	534.03		
Less reimbursement for operating expenses	85.10		
Less 238,000 kw.-hr. of exchange power delivered by Company C		$619.13	
			$2,139.67

For the simplicity of this problem it has been assumed that the equities of the three companies warrant an equal distribution of the savings. Of course this is not always true in practice, but will depend entirely on local conditions.

While this problem has been stated in as simple form as possible to show the fundamental principles, it might be well to enumerate some of the complications and refinements necessary in actual application:

Primary contracts between exchange members or with outside companies.

Calculation methods for pump-back hydro station.

Calculation methods for a steam station containing three major types of equipment, including a mercury boiler.

Proper coal prices including shrinkage, varying amounts of spot coal and contract coal, etc.

Line loss calculations, including fixed percentages and those depending on factors necessitating hourly calculations.

Hydro evaluation based on alternative market value.

Value of long-time hydro storage.

Distribution of savings based on a priority due to exchange previously existing.

Determination of operating reserves necessary for independent operation.

Allowance for reactive-kilovolt-ampere transfers.

In conclusion, it might be said that every system will have its own local problems and these will have to be solved by applying the fundamental principles. All Connecticut Valley Power Exchange problems, no matter how simple or how complicated, have been solved by these principles. The keynote of all the calculations is the thought that they are predicated upon the comparison of exchange operation with independent operation.

Safeguarding and C

By R. H. ROGERS

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CONVEYORS or process machines that operate on material in sequence must be safeguarded electrically so that if any one unit becomes incapable of taking its full quota the preceding machines will feed at a lower rate or stop. The subsequent machines may proceed to clear the system or they may be made to slow down or stop. Conveyors which feed different materials to a common hopper can be so connected that a change in material flow on one will cause a proportionate change in the other. A machine processing material can be arranged to control the output of the preceding machine on the basis of either quantity of material on hand or by motor load.

Several interesting principles are used for control of this kind and a few examples will serve to show how broadly they are applied.

The control system between a starcher and a tentering frame is shown in Fig. 1. The cloth between the units passes up over a counterweighted roller that slides up and down in guides. The more goods between the units the higher the roller goes. By means of a chain-and-sprocket drive the height of the roller determines the brush setting and hence the speed of the motor driving the starcher. In this case the driver is a 3:1 speed-range brush-shifting a.c. motor. A field rheostat for a d.c. motor could be operated in the same manner.

A thrustor for operating the gate between a supply of cotton from the bale opener and the hopper that feeds a picker is shown in Fig. 2. The bale openers feed to a conveyor which runs between standing sides to another

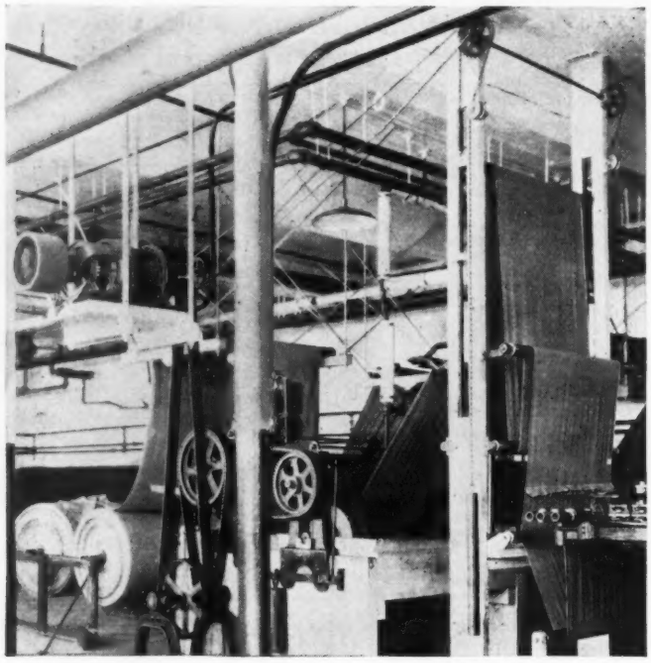


Fig. 1—Relative speeds of starcher and tentering frame regulated by slack between units

Increase or reduction of slack reduces or increases speed of brush-shifting motor at upper left.

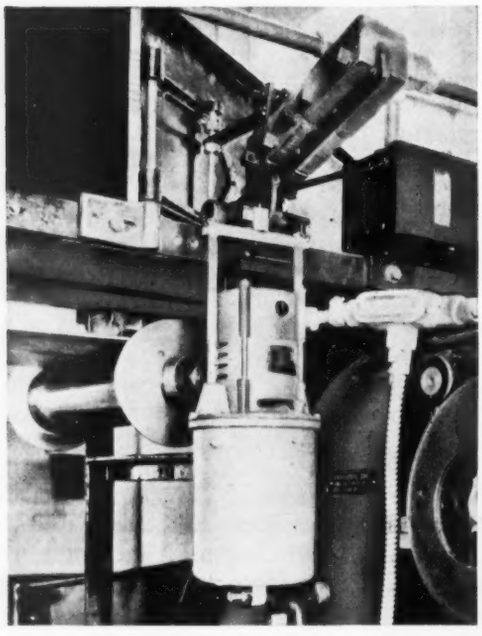


Fig. 2—Thrustor deflects supply to picker hopper when full

Mercury switch on depressible flap in hopper actuates thrustor.

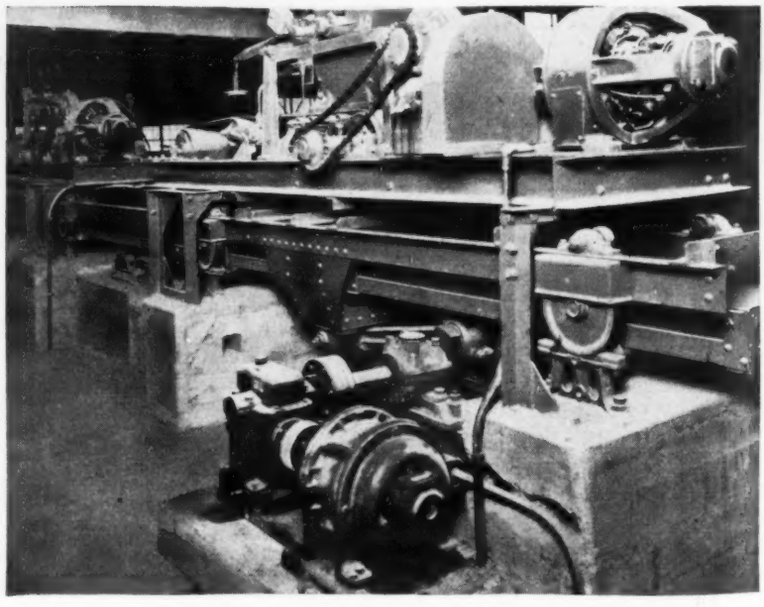


Fig. 3—Poidometer regulates proportion of components fed to cement mill

Disturbance of predetermined proportions starts drive that turns field rheostat and adjusts conveyor speed.

Controlling Sequence Operations

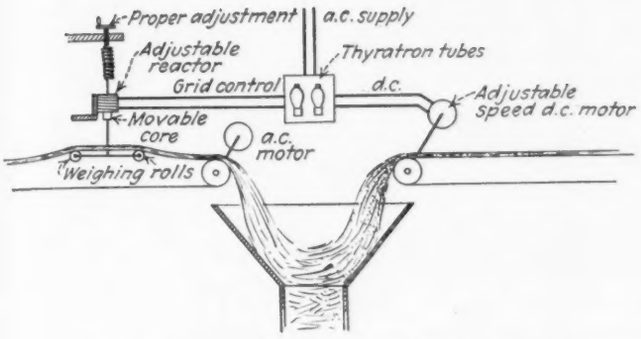


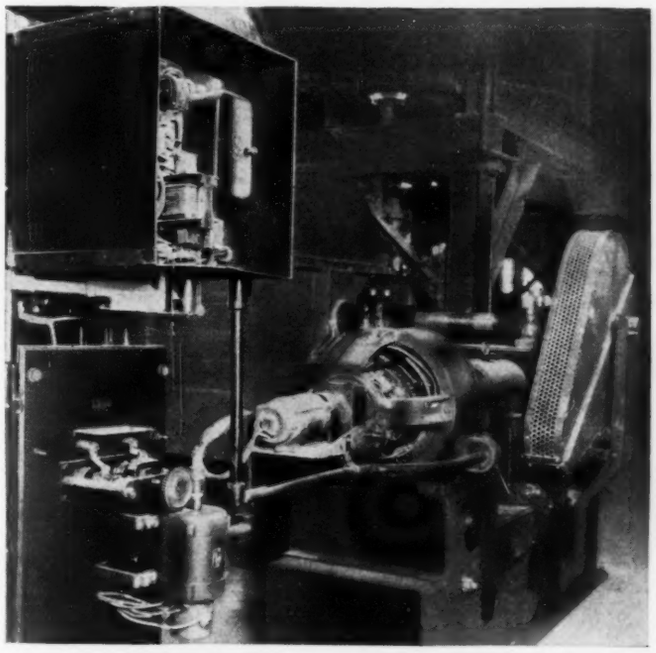
Fig. 4—Adjustable reactor and "thyratrons" control relative feeds of conveyors

Used in chemical plant where accurate proportion of ingredients is required.

room containing ten pickers. Each picker hopper is equipped with a depressible flap, which, when the hopper is about three-fourths full, tips a mercury switch and starts the thrustor motor. The thrustor then firmly but smoothly raises a deflector gate from the conveyor belt and lets the cotton pass on to some other hopper. Should all ten thrustors and gates be raised at once, the normally open contactors in series are all closed and a circuit is completed which shuts down the conveyor motor in the opener room.

The tube mills in a cement plant are fed with two materials. The raw grinding mills receive limestone and shale and the finish mills receive clinker and gypsum. It is necessary to have close regulation of the proportions for uniformity of product and control of total quantity to get maximum satisfactory output from the mill. A common device for proportioning is called a poidometer (Fig. 3), in which a section of each conveyor belt passes over a floating pulley connected to a weighing beam. Whenever either beam is disturbed by a change in the material flow it puts into gear a drive which turns a field rheostat and changes the speed of the conveyor. The weights in the scale beam can be moved only by the chemist but the speeds of the two motors can be changed a like amount by the miller. Thus one has charge of proportions and the other of quantity. In the event that one supply or the other falls below a predetermined minimum contacts are opened and both feeder motors are stopped, but the tube mill continues to operate.

A more refined system of proportioning in which the scale beam is relieved of any mechanical work and is thus more sensitive and accurate is in operation in a chemical plant. "Thyratron" tubes, which are mercury-vapor rectifiers, convert a.c. supply into armature current for a 5-hp. d.c. motor or field current for a 500-hp. d.c. motor. The output is instantly and precisely varied by an adjustable reactor connected in the tube grid circuit. In the case mentioned a reactor core is suspended from the



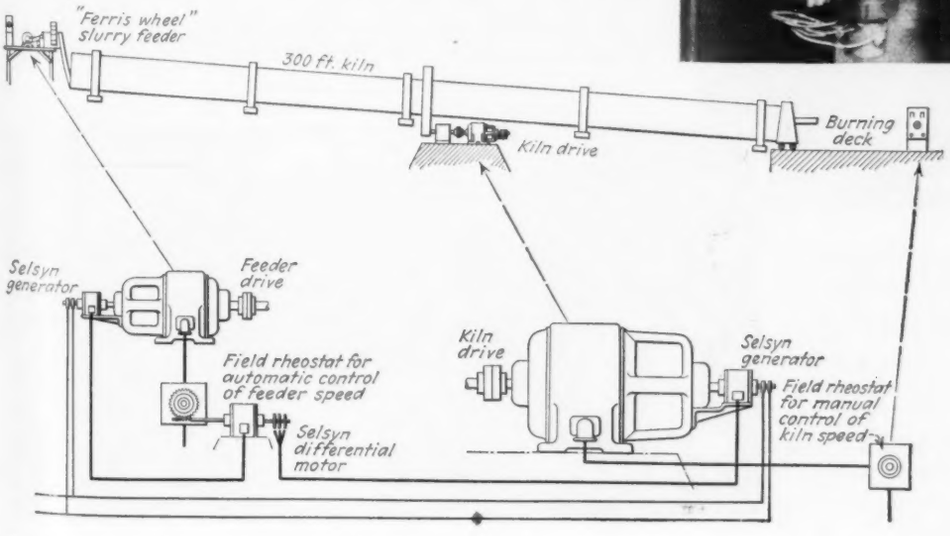


Fig. 5a and b—Selsyn unit adjusts slurry feed to kiln speed

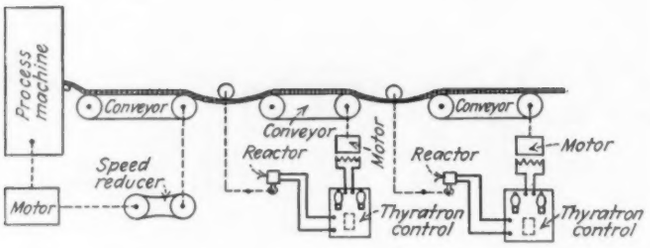


Fig. 6—Thyratron control co-ordinates motor drive

scale beam and any movement of the core changes the reactance and the "thyratron" output. The motor driving one conveyor is controlled by its armature circuit, which comes from "thyratrons" controlled by the scale beam on the other conveyor (Fig. 4).

Sometimes it is necessary to vary the speed of a process machine and it is desirable to vary the feed in a like manner. Mechanical drive from machine to feeder may not be possible or desirable and manual control leaves too many chances for error. For such instances the "Selsyn" control is ideal, for by its use the feed varies precisely with the machine. An example is found in the cement industry.

A master "Selsyn," or self-synchronizing unit, is connected to the shaft of the kiln motor and a receiving "Selsyn" (Fig. 5) is connected to the shaft of the feeder motor. The output of one is connected to the stator of a differential "Selsyn" whose rotor is fed by the other. When the feeder motor speed corresponds with the kiln speed and differential "Selsyn" rotor stands still, but if the kiln is speeded up or slowed down by even a very small amount the differential rotor must turn. This rotor is geared to a rheostat in the feeder motor field, and as soon as the feeder motor speed is changed the precise amount necessary the balance is restored and the differential motor becomes static again.

One of the biggest manufacturers of rubber goods operates several conveyors in series carrying a continuous sheet of rubber. As the speed of the process machine is changed the speed of the conveyors taking the material away must change to correspond. The nature of the material is such that a uniform loop must be maintained between conveyors to minimize damage. "Thyratron" equipment is used for this service. A light roller (Fig. 6) rides in each loop and a reactor core is suspended from each roller. The "thyratron" output regulates the speed of the motor driving the succeeding conveyor through the slight movements of the reactor core.

Interlocking of control on coal and ore conveyors is common practice. In general, a section that stops causes all sections feeding it to stop and the succeeding units continue to clear the system. However, there are modifications. In some instances one push button stops all the conveyors and related machines beginning at the source of flow of material. A time-delay device allows each unit to clear itself before it stops. The start push button starts up the unit in reverse order, insuring that all are running before material starts to flow.

There is a coal conveyor system (Fig. 7) in operation in Pennsylvania that is 4.3 miles long and extends through a mountain between a mine and the shipping point. It carries 10,000 tons per day on 22 belt conveyors in series. The motors aggregate 2,000 hp. They start up in sequence, beginning at the delivery end. As each motor comes up to full speed it energizes the starting circuit for the next. Should any motor stop all preceding units are stopped and all following units continue to run to clear themselves of coal.

Steel mill run-out tables are held in synchronism with the steel mill rolls in a simple way. An a.c. generator is chain driven from the mill stand and its frequency is therefore a function of the roll speed. This generator drives the run-out table roll motors (Fig. 8) and, as their speed varies with the frequency, synchronism is maintained at all roll speeds.

Printed wrappers for packages are ordinarily individual sheets which are fed to the packaging machine. A large cereal manufacturer is operating packaging machines taking wrappers from a printed roll at 500 ft. per minute. It was impossible to set the machine so that it would continue to cut wrappers without creeping into the printing. The problem was solved by the use

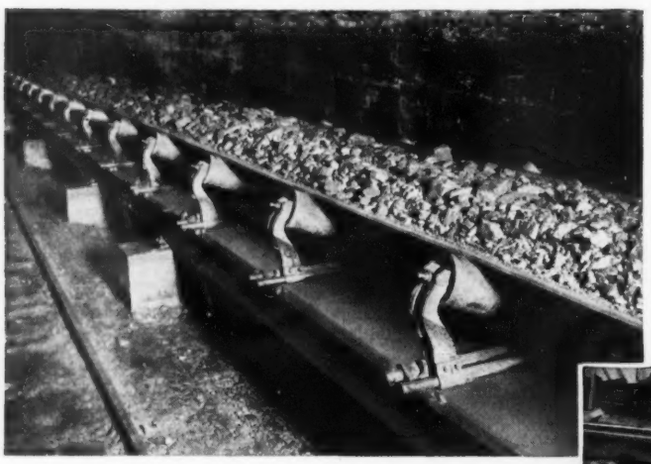


Fig. 7—Portion of 4.3-mile coal conveyor having sequence control of 22 sections

Rolls can be repaired or inspected without stopping conveyor by unlatching roll stand

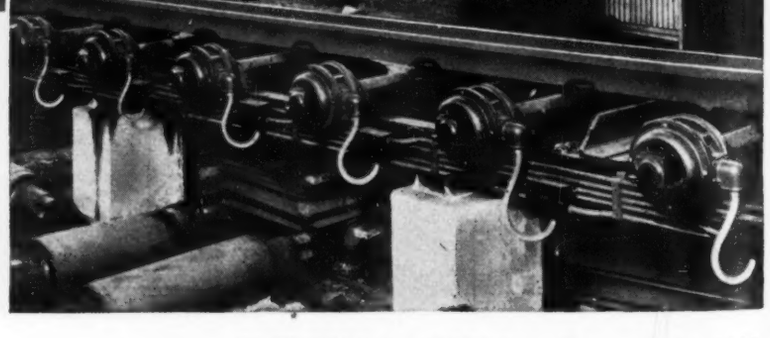


Fig. 8—Runout table motor speed controlled by mill speed

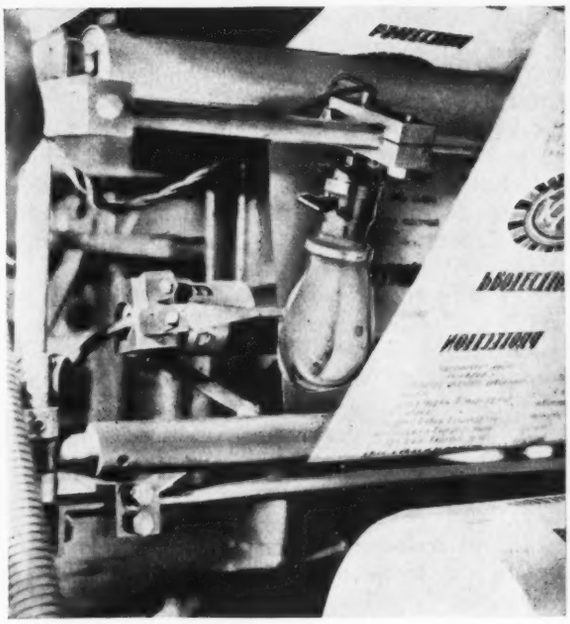


Fig. 9—Photo-electric registering control for packaging

Assures cutting of wrapper at desired place.

of a photo-electric tube and a pilot spot printed on the wrapper (Fig. 9). When the spot passes the tube the light value is changed and the consequent change in an electric circuit adjusts the speed of the rotary cutter to chop off a wrapper every time at the desired place. The photo-electric tube "sees" the spot for about one-four-hundredth of a second.

Many of the devices used in the preceding references were not yet developed as recently as three years ago, hence modernization in some respects may have to do with replacement of things that are comparatively new in sense of the life of most shop equipment.

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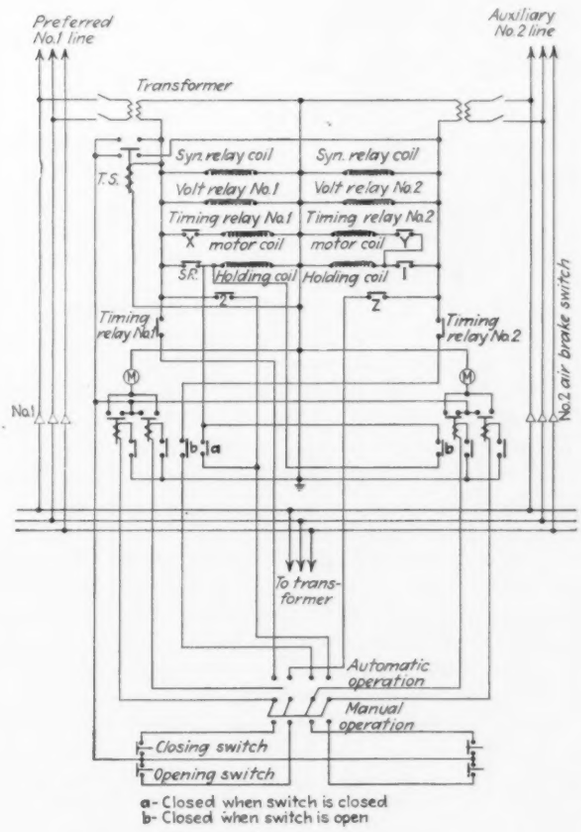
Relay Scheme for Preferential Feeder Control

To meet the demand for automatic feeder connection in locality substations serving outlying districts of the New England Power Association system, states C. W. Jones, New England Power Engineering & Service Corporation, Boston, the following scheme was devised. The typical substation has three 667-kva. transformers, 22,000/2,300 volts, supplying three distribution feeders. All the feeders are equipped with two 60-kva. self-contained induction feeder regulators and are protected by reclosing oil circuit breakers. Each breaker is adjusted for three reclosures timed at 15, 30 and 75 seconds, after which the breaker locks out. An operation counter indicates what number of reclosures have occurred. The transformers are supplied with power from a 22,000-volt bus through a set of fuses to protect the transformers. Tap lines from two 22,000-volt feeders supply the 22,000-volt bus with power through two motor-operated air-break switches.

Under normal operation the air-break switch on the preferred line is closed and the air-break switch connected to the auxiliary supply is open. If the preferred line goes into trouble and the breaker at the source of power opens, de-energizing the line, No. 1 air-break switch opens and No. 2 air-break switch closes, provided that the auxiliary supply line is energized. When the preferred line becomes alive again No. 1 air-break switch closes after a predetermined interval and provided the two lines are in synchronism. As soon as No. 1 air-break switch closes No. 2 air-break switch opens, restoring the substation to normal. The air-break switches can be made manually operative for test and maintenance purposes.

The detailed automatic relay operation is as follows: Referring to the accompanying diagram, when the preferred line becomes de-energized the No. 1 undervoltage relay loses potential, causing its contact (1) to close. If the auxiliary line is alive, the holding coil of No. 2 motor-operated timing relay is energized, closing contact *Z* and setting the motor in operation through contact *Y*, which is normally closed. Contact *Z* in closing immediately opens No. 1 air-break switch on the preferred line. After a predetermined interval contact T.R.2 closes, closing No. 2 air-break switch on the auxiliary line through the interlock switch *(b)* on No. 1 air-break



Automatic relay connections for preferred feeder operation

switch, which is closed when the air-break switch is open. This prevents closing No. 2 switch when No. 1 is closed. As soon as contact T.R.2 closes, contact *Y* opens, interrupting the motor circuit. This condition exists until the preferred line becomes alive again, in which case No. 1 undervoltage relay is energized, opening contact 1. This

allows the No. 2 timing relay to reset, closing contact *Y* and opening contact T.R.2. As soon as the No. 1 and No. 2 lines have been in synchronism a certain time contact S.R. closes, energizing the holding coil of No. 1 timing relay. Contact (*X*), being normally closed, starts the motor of the relay, which after a predetermined time closes contact T.R.1, which in turn closes No. 1 air-break switch. Contact *X* opens when T.R.1 closes, opening the motor-coil circuit. When No. 1 switch closes, contact *a* also closes, opening No. 2 air-break switch and restoring the station to normal.

Power to operate the motor mechanisms is selected from the live line or, if both lines are alive, from No. 1 line by the throw-over switch (T.S.). The air-break switches are made non-automatic by throwing the four-pole, double-throw switch to the manual operating position. In this position the air-break switches are controlled at will by the closing and opening switches.

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READERS' FORUM

Is Radio Broadcasting Suffering Persecution?

To the Editor of the ELECTRICAL WORLD:

After having set up the entertainment miracle of the century; after having built in the last five years the greatest human-service institution on earth, the broadcasters now find themselves "under fire" that amounts to incrimination. Politicians, press, special interests, and others, all join in the attack.

But shall it be the rôle of the electrical industry, which has benefited so greatly from the broadcasters' services in this wonderful adventure of the past decade, to join with the mob of their assailants? Or does simple justice dictate that electrical men shall consider carefully where their own allegiance lies—even their obligation to stand by and interpret to the public the great accomplishments of broadcasting?

With the introduction of the Senate resolution calling for an investigation of advertising in broadcasting, with the move to take 15 per cent of the wavelengths for "educational institutions" and with the filing of Senator Dill's bill to destroy clear channels the forces which would tear down the present wonderful radio system begin to get in their work.

Lest the electrical industry and trade itself share in these general attacks on the broadcasters, who are the very foundation of our business, I feel that it is time for plain talk.

Where does the present attack come from?

From certain newspaper interests which eye radio enviously as competition.

From blocs claiming places in the air to disseminate their own propaganda.

From politicians eager to fix their own political fortunes, by utilizing radio's popularity, and by getting close control over stations back home through the 15 per cent grab of "educational" wavelengths.

From small stations envious of the greater service and popularity of the successful broadcasters.

On the one hand we have the most marvelous entertainment and educational system that ever existed, a creation of the past five years. And arrayed against it are selfish interests who would destroy all that has been created, in order to benefit from the wreckage.

There is no question on which side lie the interests of the electrical radio trade and industry. Broadcasting is the radio industry's very lifeblood. And the present American system of paying for programs through advertising has brought to American broadcasting the greatest aggregation of talent in the world.

Every man who derives his livelihood from radio in any way owes it to himself, his family and his industry to help strengthen the hands of the broadcasters at this critical time. The American system of broadcasting is entitled to a square deal. The American system brings free to the American public nightly "the greatest show on earth." If advertising has protruded itself objectionably, that is bound to be self-corrective.

But let no rocks be thrown from inside radio's own camp. In the battle now starting the interests of all radio men are bound up together.

It is the duty of the radio industry to strengthen—not to weaken—the very foundations of its own existence and prosperity—the American system of broadcasting by which the choicest talent and entertainment are brought free to every home in the land.

ORESTES H. CALDWELL,
Former Federal Radio Commissioner.

Greenwich, Conn.

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Average Prices for Reproduction

To the Editor of the ELECTRICAL WORLD:

Frequently the ELECTRICAL WORLD prints the opinion of some political or non-partisan writer to the effect that the amount used as a rate base by the utilities, the "investment used and useful in the service of the public," should be scaled down to fit present-day labor and material prices. This appears logical at first glance, especially to those of us who have watched the values of improved real estate on the toboggan.

There is an essential difference, however. The value of your dwelling is low today because it can be duplicated in a few weeks with low cost labor and materials. The value of your public utility system does not decrease in the same ratio, because it cannot be so duplicated. The amount of money invested in utility equipment is too large to be efficiently spent during a few months' panic period. Construction must extend over a period of ten, fifteen, twenty years, and hard times do not last that long.

Even if we grant that the colossal sums represented by utility investment could be spent during hard times and that such spending would not send labor and material costs skyrocketing, the proponents of an investment write-off have gained nothing. Utility systems are not "built" in this wholesale manner. They "grow" unit by unit, line by line, customer by customer. This growth takes years, and years are sometimes fat, sometimes lean. A reasonable calculation of "replacement cost" should use, say, ten-year-average prices, not concentrate on present abnormal conditions.

STANLEY GILMORE.

Columbia, Mo.

Men of the Industry

A. E. Holloway Elected Vice-President in San Diego

A. E. Holloway, who was elected vice-president in charge of sales of the San Diego Consolidated Gas & Electric Company, as announced in the February 13 issue of the ELECTRICAL WORLD, became associated with that utility in 1910 as a salesman. Mr. Holloway was so successful in this field that before the year had ended he was occupying the position of new-business manager. In

1921 he was made commercial superintendent of the company.

Mr. Holloway was born in Colfax, Ind., in 1887. He received his B.S. in electrical engineering at Purdue University. Upon leaving school he became deputy county surveyor for Clinton County, Indiana, and in 1909 joined the Westinghouse Electric & Manufacturing Company, East Pittsburgh. Following this connection, he affiliated himself with the San Diego Consolidated Gas & Electric Company. Mr. Holloway is a member of the San Diego Electric Club, San Diego Chamber of Commerce, Pacific Coast Electric Association, Pacific Coast Gas Association, California State Chamber of Commerce and Southern California Economic Council.

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ALEXANDER GADDESS, formerly director of public relations of the Pennsylvania Electric Association, has been appointed manager of publicity of the public relations department of the United Gas Improvement Company. C. E. WETZEL, who for several years has been in charge of publicity for U.G.I. and system companies, outside of Philadelphia, will devote his time to advertising work for those companies. Mr. Gaddess is a native of Baltimore and had been engaged in newspaper work for a number of years in Philadelphia and New York before entering the public utility field.

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A. V. BARTLETT has been elected president of the Electrical League of Rhode Island for 1932.

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ALBERT H. MYERS, who was for several years executive engineer for the Wellman Engineering Company, Cleveland, Ohio, and for the past five years district representative for Stone & Webster, Inc., in the Milwaukee, Wis., district, announces the establishment of a literature research service to architects, engineers and patent attorneys, as well as to industries which they may represent. Mr. Myers is at the present time making his headquarters in Milwaukee.

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JOHN C. MELLETT, Indianapolis, author and former newspaper man, has been appointed publicity and advertising manager of the Indiana group of utilities which are subsidiaries of the Midland United Company. E. Frank Gardiner, who has been holding this position as well as that of publicity director of the Midland United, will continue to serve the subsidiary companies in an advisory and supervisory capacity, but will devote most of his time to the affairs of the holding company.

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HARRY C. SMITH of Idaho has been appointed assistant chief engineer of the Federal Power Commission. Mr. Smith's experience in hydro-electric engineering extends over a period of eighteen years. He has made thorough and extensive studies of the power resources of the Tennessee and Cumberland Rivers and tributaries. Mr. Smith was born in Idaho in 1881 and was graduated from the University of Idaho in civil engineering in the class of 1905. He was employed on railroad work in Idaho during the first year after graduation and in the fall of 1906 went to the Philippines as an engineer for the insular government, in charge of harbor work. Since 1913 he has been in the service of the War Department, engineer department at large, and during that time has been employed in the United States engineer offices at Norfolk, Va., and Chattanooga and Nashville, Tenn. It is expected that Mr. Smith will report for duty with the commission on or about March 15.

Grothaus Assumes New Duties With Allis-Chalmers

L. W. Grothaus, recently appointed to succeed C. E. Searle as general representative of the Allis-Chalmers Manufacturing Company, needs no introduction to the industries of power generation and utilization. He became affiliated with the Allis-Chalmers Manufacturing Company with the acquisition of the Bullock Electric Manufacturing Company, Norwood, Ohio, in 1904. Mr. Grothaus was transferred to the home office at Milwaukee in 1908, which made possible a thorough knowledge of all of the products manufactured by the company.

In 1913 Mr. Grothaus became sales engineer in the Milwaukee district, under the leadership of C. E. Searle, and con-

tinued in that capacity until 1917, when his services were loaned to the government as a member of the staff of the War Industries Board. Due to his thorough knowledge of the electrical and power generating machinery he was assigned, among other duties, the responsibility of allocating the capacity of the steam turbine industry to the war needs of the army, navy, Emergency Fleet Corporation, etc. He remained a member of the War Industries Board until December 31, 1918. Returning to the company, he was made manager of the Minneapolis district office and, later, given charge of the Cleveland sales district. He was next promoted to the position of assistant manager of the electrical department in charge of Norwood Works, and in the fall of 1929 he was transferred again to the home office at Milwaukee, to take up new duties as assistant manager of the electrical department. His appointment as general representative became effective January 1, 1932.

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G. B. PULHAM, for the past six years chief erecting engineer for the Metropolitan-Vickers Electrical Company, Ltd., in India, Burma and Ceylon, is leaving Calcutta this month to return to England.

OBITUARY

Harold B. Smith

Harold B. Smith, whose death was announced in the February 13 issue of the ELECTRICAL WORLD, was one of the best-known figures in the engineering and educational world. His distinguished reputation in the field of electrical engineering was the outcome of researches in solid dielectrics and high-voltage phenomena which extended over more than a quarter of a century, and his work as an educator also won for him the regard of his colleagues in the teaching profession and the appreciation of many students.

In 1892, following graduation from Cornell University, he was appointed professor of electrical engineering in charge of the department at the University of Arkansas. Resigning from this position, he became head designer and electrical engineer for the Elektron Manufacturing Company, Springfield, Mass., and then spent three years as director of the department of electrical engineering at Purdue University. Professor Smith retained a connection with the Elektron Manufacturing Company as consulting engineer until 1902 and did consulting work for several other organizations at various times. Since 1905 he had served as a consulting engineer for the Westinghouse Electric & Manufacturing Company until his retirement on account of ill health a year ago.

In association work Professor Smith had been very active. He was a past-president of the American Institute of Electrical Engineers and was at various times a member of a number of special committees of the Institute. His other memberships included American Society of Mechanical Engineers, Institution of Electrical Engineers (Great Britain), Society for the Promotion of Engineering Education and the American Association for the Advancement of Science.

Charles F. Scott, professor of electrical engineering at Yale University, paid the following tribute to Mr. Smith:

Professor Smith's untimely death closes the career of one of our older and most effective electrical engineering teachers. He was distinguished also as a research worker. He once told me that on graduation from Cornell he gave careful thought to the line of work which he should follow. He found that investigations regarding electric circuits and magnetic circuits had reached a mature state of development and their principles and properties had been well established. The dielectric field, however, was still one of uncertainty and mystery and he therefore decided that his interest and energy should be devoted to it. In a few years his high-tension transformers and dielectric investigations gave him a prominence in this field which continued through his life.

I knew him for some thirty years, in which time there had been increasing friendship and respect. Outstanding among his qualities were his seriousness, earnestness and persistence, his quiet enthusiasm and intellectual honesty and his sympathetic understanding, both of nature's laws and of men.

A tribute to Professor Smith was sent to the ELECTRICAL WORLD by Charles Fortescue, consulting transmission engi-

neer of the Westinghouse Electric & Manufacturing Company. It said:

I have heard with much regret of the death of Professor Harold B. Smith. All who are familiar with his early work in high-voltage engineering will agree with me that the engineering profession has suffered a great loss. In my associations with Professor Smith in connection with high-voltage engineering I derived much benefit and inspiration from his unselfish advice, his courage and well-grounded optimism.

In commenting on the death of Professor Smith, Ralph Earle, president of the Worcester Polytechnic Institute, said:

With the death of Professor Harold B. Smith, until recently head of the department of electrical engineering at the Worcester Polytechnic Institute and recent past-president of the American Institute of Electrical Engineers, both electrical engineering and engineering education have sustained a serious loss. Professor Smith established the electrical engineering course at the Worcester Polytechnic Institute in 1896 and developed it into one of the departments of recognized high standing in the United States. It was through his initiative, perseverance and guidance that the electrical engineering building at Worcester was built in 1906. The fact that there have been very few changes in the staff, except for additions, during the past 30 years is in itself a remarkable tribute to Professor Smith. Professor Smith was always interested in following and promoting the development of the graduates of his department and his advice was often sought and frequently followed by these men.

WILLIAM NESBIT, northeastern engineering manager of the Westinghouse Electric & Manufacturing Company prior to his retirement two years ago, died December 31 after a long illness. Mr. Nesbit became identified with the Westinghouse organization in 1897 as a member of the apprentice course at the main office in East Pittsburgh. The following year he was placed in charge of transformer testing and in 1900 he became transformer designer for the company. Then he served successively as sales engineer at the Syracuse office, in the New York office, manager of the company's engineering division in New York and finally as northeastern manager. To technical literature he contributed the book "Electrical Characteristics of Transmission Circuits," a work used extensively as a college text-book. Mr. Nesbit was 55 years of age.

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BERTRAM P. WILBER, assistant designing engineer of the New York Edison Company, New York, died at his home in Great Neck, L. I., late in December. Mr. Wilbur was born in Philadelphia and received his education in that city and in New York. His apprenticeship was served in the machine shops of the Pennsylvania Railroad Company. From 1894 to 1905 he was employed by the New York Edison Company as draftsman, designer and chief draftsman in the design and construction of power plants and substations. From 1906 to 1916 he was assistant electrical engineer for L. B. Stillwell, in charge of the drafting office on the design and construction of power plants, factories, estimating, inspection, testing, etc. He also was connected with the Pratt Engineering & Machine Company and with Westinghouse, Church, Kerr & Company.

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ERNEST C. HEADRICK, owner of the Headrick Electric Company and, for more than a decade, secretary of the Electrical League of Colorado, died suddenly at his Denver home February 8. Mr. Headrick's connection with the electrical industry dates back to 1888, when he moved from his birthplace, Johnstown, Pa., to Pittsburgh, where he entered the private laboratory of George Westinghouse. In 1900 he went to France as representative of the Westinghouse Electric & Manufacturing Company, and continued in this capacity until his return to the United States in 1909. Establishing himself in Denver, Mr. Headrick became a prominent figure in the local electrical contracting business. He was a charter member of the Electrical League of Colorado, serving three times as president, in 1910, 1920 and 1921. Since then he had been secretary. He was also past-president of the Denver Electrical Contractors, of which he had been a member since 1915.

Trade News

The Appleton Electric Company, Chicago, has just issued its new No. 10 "Unilet" catalog, consisting of 226 pages devoted entirely to the listing of Appleton threaded and no-thread malleable unilets, as well as threaded and no-thread couplings, connectors, etc.

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George Belsey Company, Ltd., southern California distributor of General Electric refrigerators, with headquarters in Los Angeles, will take over the sale of General Electric Hotpoint ranges.

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The Badenhausen Corporation of Cornwells Heights, Pa., announces the election of the following officials and board of directors: President and director, F. H. Daniels; vice-president and director, James W. Armour; secretary-treasurer and director, William N. Way; assistant treasurer and director, E. G. Stoler; director, David K. Beach. Messrs. Daniels, Armour and Beach are also officials of the Riley Stoker Corporation of Worcester, Mass. John Philips Badenhausen has severed his official connection with the Badenhausen Corporation.

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Automatic Switch Company, Detroit, Mich., manufacturer of oil circuit breakers, announces the appointment of the Federal Electric Company, Chicago, Ill., as an agent for the sale of its automatic switching equipment.

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Announcement has been made that R. H. Best has become associated with the James R. Kearney Corporation of St. Louis, Mo. Mr. Best will represent the Kearney corporation in the mid-south, handling, in connection with Kearney products, the Chance anchor and pole line specialties and Tips hot line tools, both of which are controlled by the Kearney corporation. He will take over his new duties March 1 and will maintain his headquarters at Little Rock. He was formerly connected with the Public Service Company of Northern Illinois and more recently with the Arkansas Power & Light Company.

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In a suit for infringement against the Kodel Electric & Manufacturing Company, a decision has been handed down by the United States Court of Appeals, Sixth Circuit, in which the patent on the copper-oxide rectifier has been held valid to the extent that it covers the rectification over an extended area at an internal boundary, which is the real gist of the invention.

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After nearly two years of preparation a comprehensive 262-page loose-leaf book covering technical data and catalog features of Burndy electrical connectors and conductors has been published by the Burndy Engineering Company, Inc., New York. This publication, identified as No. 33, is an excellent coverage of practices and equipment for any engineer whose activities involve the joining of tubular buses, flat bars, cable, or any type of conductor.

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Synthane Corporation, Oaks, Pa., manufacturer of Synthane laminated bakelite, sheets, rods, tubes, fabricated parts and stabilized gears, has appointed H. Douglas Stier, 101 Marietta Street, Atlanta, Ga., as sales representative. He will cover the territory of Georgia and Alabama, bringing manufacturers in these states in direct contact with the services of the Synthane Corporation.

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Kelvinator Corporation reports shipments for January 23 per cent in excess of those for January, 1931, and shipments for January, 1931, were 12 per cent over those for 1930. Orders received during January were 30 per cent in excess of orders received during January, 1931, and February opened with more than double as many unfilled orders on hand as a year ago.

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Directors of the Okonite Company recently voted to omit the quarterly dividend usually payable February 1 on the common stock, par $100. The company on August 1 and November 2 made quarterly payments of $1 per share on this issue, as against $1.50 previously.

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CeCo Manufacturing Company, Inc., Providence, R. I., announces the formation of an industrial division to develop electrical and electronic devices for industrial purposes. C. O. Cressy will be the engineer in the industrial division who will be assigned to the application of this division's products.

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The Corning Glass Works announces the appointment of Wise & Braisted, with offices in Detroit, as its agent for the sale of "Pyrex" power insulators in the state of Michigan.

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John S. Webb, formerly associated with Alfred Kellogg, consulting engineer, of Boston, has been appointed general sales manager of Webster Tallmadge & Company, Inc., New York, manufacturer of zoned heating systems with simplified orifice distribution and electrical remote control.

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Edwin C. Wehle, president of the Southern New York Electrical Supply Corporation, has been elected chairman of the newly formed Association for the Promotion of Electrical Refrigeration of Binghamton, N. Y.

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BUILDING PASSENGER LOCOMOTIVES

A scene in the Erie, Pa., shops of the General Electric Company, where large and powerful electric motors are being built for the new passenger locomotives of the Pennsylvania Railroad.

New Equipment Available

Automatic Fuse Throwout

An automatic fuse throwout attachment, known as the "Pullink" and having several features, has been developed by the W. N. Matthews Corporation, St. Louis, Mo. By throwing the burned fuse link free of the switch or cutout

the instant the overload occurs this attachment eliminates surface leakage within the tube and consequent carbonization and damage to fusing equipment. It also facilitates trouble shooting, because blown fuses can be seen from a car traveling at 35 miles per hour.

The newly developed universal fuse links will fit all open type Matthews cartridges and most cartridges of other open-type cutouts and will carry their rated current for one hour without causing visible deterioration of the fuse links or adjacent parts of the cutouts. They will operate continuously at 65 per cent of their marked rating with a temperature rise of less than 30 deg. C at the upper contact.

The links will blow at 150 per cent of their rated current within five minutes starting cold (20 to 30 deg. C.), excepting fuses rated below 5 amp., which will blow at 200 per cent rated current in five minutes or less.

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A MERCURY ELECTRIC SWITCH known as "Mertact," made in sizes from 1 to 100 amp. capacities, is announced by the industrial division of the CeCo Manufacturing Company, Inc., Providence, R. I. The "Mertact" operates in a very narrow angle of swing. Sizable currents can be broken by a small mechanical force, thereby eliminating the necessity of using intermediate relays. Another advantage possessed by mercury switches is the inclosed arc feature, which permits its use where combustible gases or material are apt to accumulate.

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Incased Spark Gap for Testing Insulating Oil

An incased spark gap designed to simplify testing the dielectric strength of oil used for insulating purposes and to prevent obtaining results that will cause the condemnation of good oil and dehydrating equipment is announced by the Industrial Products Company, South Bend, Ind. Oil is delivered to the Champion spark gap by gravity and through flexible hose connected to portable containers or by pressure direct from a by-pass line in the dehydrating system, and is discharged through a small opening in the center of one of the electrodes. Likewise, gasoline for cleansing and checking the condition of the electrodes is also delivered from containers. A slight turn of the control valve supplies new oil in the spark gap and washes away all carbon particles after breakdown occurs.

Precision tests are obtained by this quick and clean method of handling samples and the operation of testing is simplified so that much larger samples of oil may be tested. The importance of increasing the speed and accuracy of testing oil obtainable with open cups is emphasized by the fact that one pint of oil will fill a standard spark gap more than 350 times, therefore the amount of oil subjected to test in open cups is seldom more than ten parts in a million.

The most distinctive feature of the Champion gap is said to be the remarkable gain in accuracy due to the elimination of open vessels, test cups and utensils. A further gain in accuracy is due to the accurate spacing of the electrodes.

The model "C" spark gap consists of standard 1-in. electrodes mounted in a clear glass casing on bakelite supports and may be connected into the high-voltage side of any test using a standard 1-in. gap. Three-point micrometer adjustments are provided.

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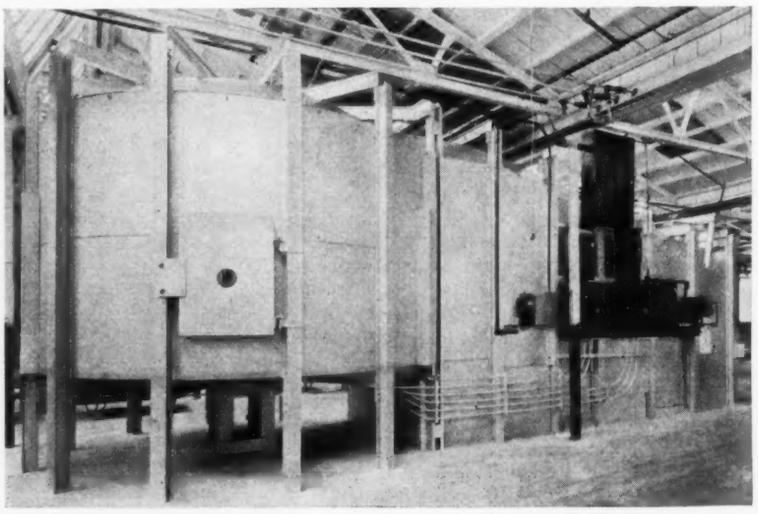
Electric Enameling Furnace for the Small Shop

To meet the demand for a small production unit the Westinghouse Electric & Manufacturing Company has developed a continuous electric enameling furnace, rated at about 1,500 sq.ft. of sheet ware per hour. The unit is approximately 40 ft. long over all and is designed to operate at a chain speed of 4 to 5 ft. per minute.

Because of its inherent over-all economical operation, the electric continuous porcelain enameling furnace has been widely adopted during the past few years. However, the majority of the installations made to date have been designed for relatively large production, equivalent to the output of about four or five box furnaces.

Such designs have not been suitable for many plants having a production equivalent to about two furnaces, consequently these plants have not felt justified in investing in a continuous furnace to take advantage of their economical operation. The Westinghouse development makes it possible for the smaller porcelain enameling plants to take advantage of continuous operation.